HOUSING MONOGRAPH SERIES NO. 3

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LAND, MATERIALS, AND LABOR COSTS

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A TECHNICAL MONOGRAPH ON HOUSING
PREPARED FOR THE
INDUSTRIAL COMMITTEE
OF THE
NATIONAL RESOURCES COMMITTEE

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HOUSING MONOGRAPH SERIES NO. 3

LAND, MATERIALS, AND LABOR COSTS

PART I. LOCATION FACTORS IN HOUSING PROGRAMS
by Jacob Crane

PART II. SITE PLANNING
by Frederick Bigger

PART III. THE SIGNIFICANCE OF SMALL HOUSE DESIGN
by Pierre Blouke

PART IV. BUILDING MATERIALS AND THE COST OF HOUSING
by Theodore J. Kreps

PART V. LABOR AND THE COST OF HOUSING
by Mercer G. Evans

PART VI. BUILDING REGULATIONS AND THE HOUSING PROBLEM
by George N. Thompson

A TECHNICAL MONOGRAPH ON HOUSING
PREPARED FOR THE
INDUSTRIAL COMMITTEE
OF THE
NATIONAL RESOURCES COMMITTEE

The National Resources Committee assumes no responsibility for the views and opinions expressed herein

UNITED STATES GOVERNMENT PRINTING OFFICE - - - - - - - - - - - - WASHINGTON : 1939

For sale by the Superintendent of Documents, Washington, D. C. - - - - - - - - - - Price 30 cents

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FOREWORD

The general business depression which dominated American life following the boom years of 1926–29 was characterized by a cessation of residential building activities along with the decline of other business. Attempts were made from 1931 on to produce more healthy conditions, so that a revival might come about. Private industry alone, Government alone, and Government and industry together—all have attempted to raise the volume of home construction. All these efforts have resulted in progress but still fall far short of actually producing the number of new houses needed.

The National Resources Committee has been thrown in contact with these problems from time to time in connection with various studies.[1] During 1936–37 the Committee felt the necessity for securing more detailed information concerning a number of phases of the problems closely related to housing. Technicians in the various branches of the Government were asked to present monographs touching these particular problems. Naturally the men who prepared these documents drew on their own experience and presented their personal views which in no way represent the opinions of the agencies with which they are connected.

It was intended originally to try to develop from these individual contributions a comprehensive report on the subject of housing. The natural variety of opinions and approaches to the subject as a whole has made a single report difficult to complete at the present stage of the study. Because, however, certain of the individual contributions are timely in nature and also afford valuable material for technicians in the field, it is felt desirable to make some of them available as soon as possible in the form of technical reports. It should be held clearly in mind that these are individual expressions and that the opinions stated are those of the authors and that the National Resources Committee is not responsible for such opinions.

The six monographs contained within these covers have no continuity and are related to each other only in that they each discuss some phase of the housing problem. The contributions of Messrs. Bigger and Crane make available some new materials from Government experience in planning of large-scale housing projects. Mr. Blouke discusses "small houses" which are a primary concern of a majority of American families. Messrs. Kreps and Evans have undertaken the difficult task of discussing the highly controversial subjects of material costs and labor costs. It is regretted that it has been impossible to bring the discussion and statistical material more nearly to the date of release. Mr. Thompson has brought to the subject of building regulation and codes a mature judgment derived from a rich experience at the National Bureau of Standards. All of these men have drawn on close contacts with materials which they have discussed. As in the two previous monographs, these contributions are made available with the hope of creating a better understanding of the multitude of problems which must be solved if we are to have better housing.

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[1] Cf. *Technological Trends and National Policy, Our Cities—Their Role in the National Economy, Farm Tenancy, Problems of a Changing Population* and *Consumer Incomes in the United States*, etc.

October 22, 1938.

Mr. Frederic A. Delano, *Chairman, Advisory Committee,*
National Resources Committee,
Washington, D. C.

Dear Mr. Delano:

The Industrial Committee transmits herewith the third of a series of monographs on housing prepared at the request of the President by numerous collaborators from various agencies and assisted by a technical staff.

A study in this field was recommended by the Industrial Committee last spring, in connection with investigations of the larger problems of the construction industry. A subcommittee, consisting of Thomas C. Blaisdell, Jr., Lauchlin Currie, and C. R. Chambers (resigned Aug. 1, 1937), outlined the proposal and has given advice in the preparation of the reports under Mr. Blaisdell's direction.

Sincerely yours,

Thomas C. Blaisdell, Jr., *Chairman*

Lauchlin Currie
Charles W. Eliot, 2d
Mordecai Ezekiel
Leon Henderson
Isador Lubin
Gardiner C. Means
Harry D. White

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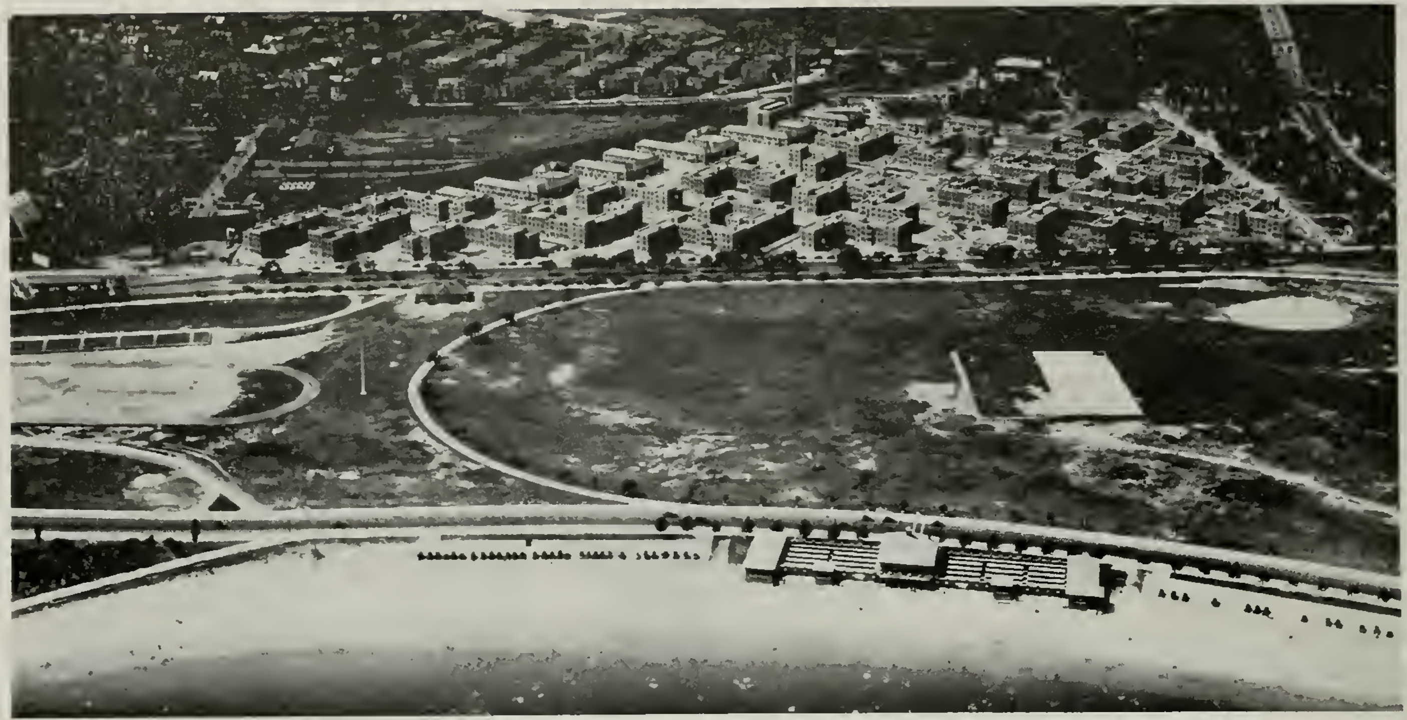
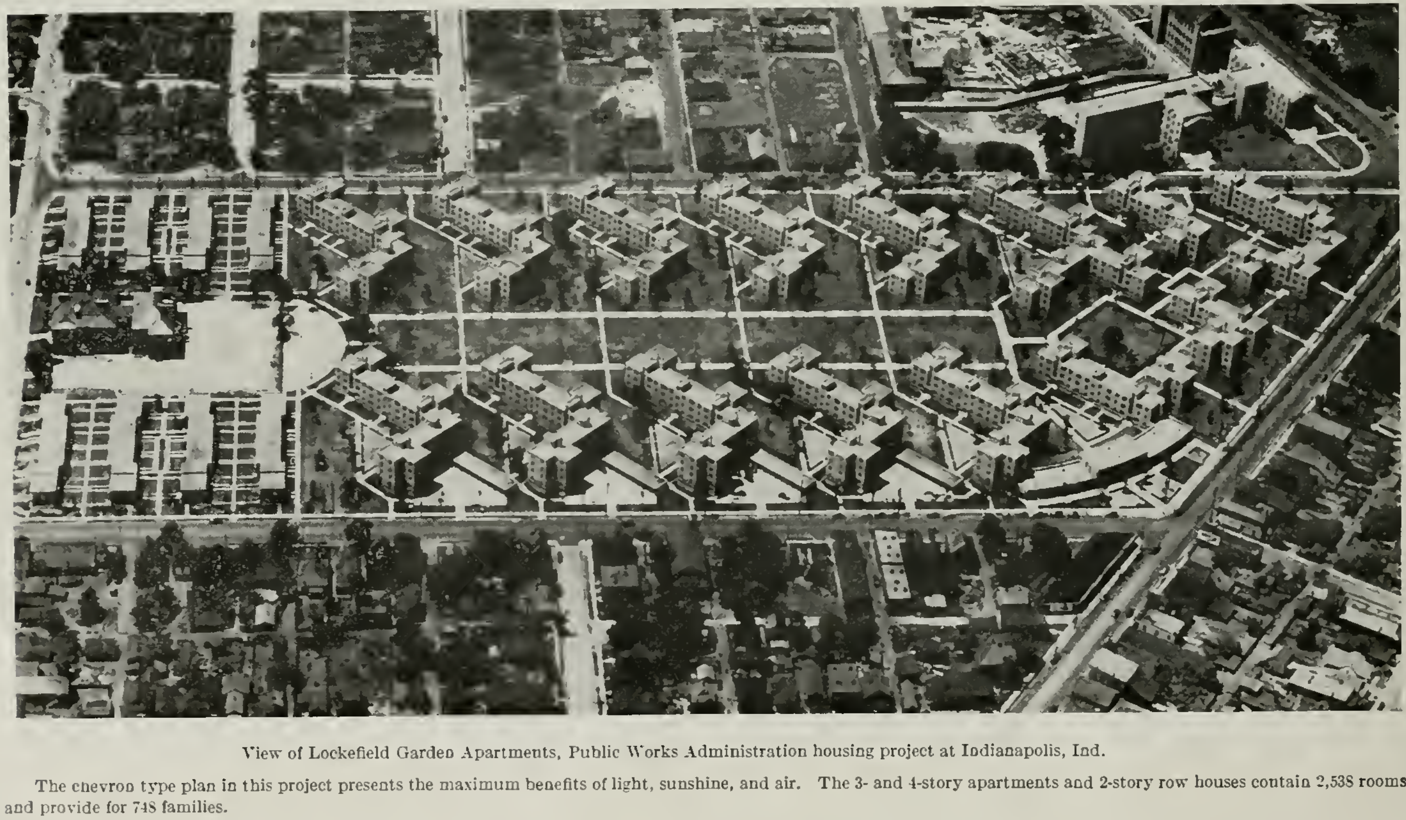


View of Old Harbor Village, Public Works Administration housing project facing Columbus Park and the Old Harbor, Boston, Mass.

The 33-acre site on Old Colony Avenue contains 3-story apartments and 2-story group houses, aggregating 3,860 rooms and providing for 1,016 families. This, the second-largest Works Progress Administration project in the country, shows a larger land coverage and denser population than some others, justified by the planners because of the adjacent public recreation area. The latter includes playground facilities, athletic facilities, stadium, bathhouse, and bathing beach. Eighty percent of the apartments have a view of the harbor.



View of Lockefield Garden Apartments, Public Works Administration housing project at Indianapolis, Ind.

The chevron type plan in this project presents the maximum benefits of light, sunshine, and air. The 3- and 4-story apartments and 2-story row houses contain 2,538 rooms and provide for 748 families.

I. LOCATION FACTORS IN HOUSING PROGRAMS

By Jacob Crane[1]

The primary thrust of the argument of this section is the necessity for thoroughly analyzing a particular housing project as it will be when completed in order to decide on location. The platitude that housing should be built where workers must work is given real meaning.

Conclusions and Recommendations

1. For this review of location factors, primary consideration is given to metropolitan districts;[2] to the early future; to a simplified classification of categories of location; and to the influence of location upon the character of housing and upon the cost of housing, particularly upon the *total monthly cost* to the occupant families.

2. The first cost of land, ready to use, generally constitutes from 10 to 25 percent of the total capital cost per dwelling, complete with land and utilities.

3. The interest and amortization charges on land for housing generally constitute from 5 to 12 percent of the total monthly cost.

4. Reducing the per-family cost of land by 50 percent by doubling the number of families per net acre generally reduces the total monthly cost by only 2 to 6 percent.

5. The location of housing influences:

a. The cost of land.

b. The type of project and, hence, other costs and livability.

c. The cost and quality of utilities services.

d. The cost of taxes.

e. The cost of municipal and community services generally.

f. The cost of interest and amortization.

g. The cost of transportation.

h. The cost of construction.

i. The cost of insurance.

j. The cost of maintenance and operation.

6. For low-income housing the first cost of land, as charged to the project, should generally not exceed $20,000 per net acre or 50 cents per square foot, ready to use; the "normal" range lies between 10 and 30 cents per square foot.

7. Location and the cost of land tend to control building density. The optimum density, all things considered, ranges from 10 to 25 families per net acre of building land.

8. For smaller projects the optimum sites are generally situated in the outer portions of the central city and its suburbs.

9. For very large projects (over 1,200 units) the garden city or garden suburb offers an excellent type of location and development, provided other important criteria are met.

10. Federal aid is suggested for the advance acquisition of metropolitan land reserves, which would be available for many purposes, including housing projects and garden suburbs.

11. The occupied slum site is at present generally not suitable for new private low-income housing developments, nor for public housing except where land costs are less than 50 cents per square foot or where policy justifies writing off by subsidy any excess above that range.

12. Except for the courageous slum-site program of the P. W. A. Housing Division, the great preponderance of recent house building, both private and public, in this country and in most of the European countries, has been placed upon outlying vacant sites.

13. Metropolitan regional planning is fundamental to successful housing programs, private and public. It is suggested that the Federal agencies concerned with housing and with local public works join forces to assist in the strengthening of metropolitan regional planning.

14. Measures are urgently needed to check "wild cat" subdividing and to facilitate or compel the pooling of property in defunct subdivisions and in blighted areas.

15. The repossession of tax-reverted land and the utilization of suitable vacant lots left over after a boom offer many suitable locations for houses and housing projects

16. The location factors cannot be separated but must be considered in the light of all the other factors with which location is interrelated. A project has to be figured all the way through, and the various alternatives appraised, before location, along with the other major elements, can be sensibly determined.

17. In the past, the flood of wasteful subdivisions and of jerry-built projects has overwhelmed attempts to rationalize the production of housing. The task of reorganizing the processes by which housing is provided, including the land factors, cannot be achieved overnight. However, the present impasse in the pro-

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[1] Jacob Crane is Assistant Administrator and Director of Project Planning, U. S. Housing Authority. At the time this section was in preparation he was not connected with the U. S. Housing Authority. He has worked as a consulting engineer with the National Resources Committee, the Housing Division of the Public Works Administration, Federal Housing Administration, and Farm Security Administration (Resettlement Administration).

[2] The New York City situation constitutes a special case and some of the conclusions reached here do not apply.

duction of houses seems to offer an opportunity to introduce more economic practices in land development, house building, and city building.

The Problem

For examining the factors of location, the metropolitan regions are given primary consideration. In these regions there lived in 1930 approximately six times as many persons as there were in all other urban places in the United States having more than 5,000 population.[3] The metropolitan districts,[4] moreover, have shown the greatest increase in number of families and hence the greatest demand for houses. With some exceptions, the evidence points to an immediate general continuance of this metropolitan growth. Further, in the smaller towns and cities, the location factors for housing are less significant, since distances and land costs are relatively much less.

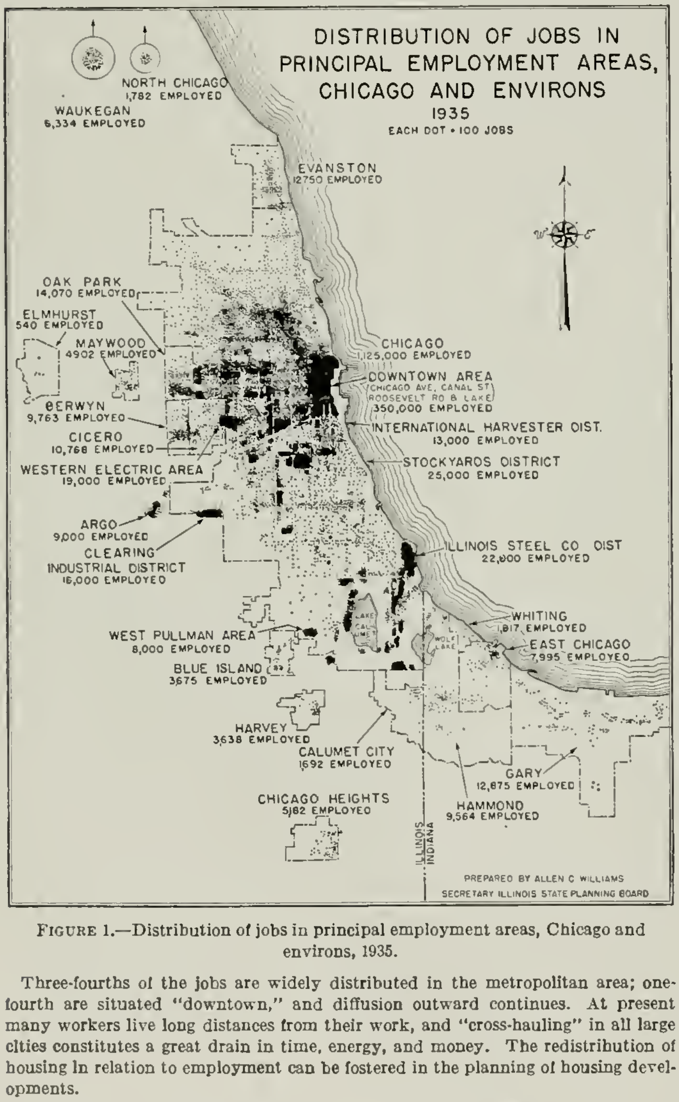
DISTRIBUTION OF JOBS IN PRINCIPAL EMPLOYMENT AREAS, CHICAGO AND ENVIRONS
1935
EACH DOT • 100 JOBS
NORTH CHICAGO 1,782 EMPLOYED
WAUKEGAN 6,334 EMPLOYED
EVANSTON 12750 EMPLOYED
W
E
OAK PARK 14,070 EMPLOYED
ELMHURST 540 EMPLOYED
MAYWOOD 4902 EMPLOYED
CHICAGO 1,125,000 EMPLOYED
DOWNTOWN AREA (CHICAGO AVE, CANAL ST ROOSEVELT RD & LAKE) 350,000 EMPLOYED
BERWYN 9,763 EMPLOYED
CICERO 10,768 EMPLOYED
INTERNATIONAL HARVESTER DIST. 13,000 EMPLOYED
WESTERN ELECTRIC AREA 19,000 EMPLOYED
STOCKYARDS DISTRICT 25,000 EMPLOYED
ARGO 9,000 EMPLOYED
CLEARING INDUSTRIAL DISTRICT 16,000 EMPLOYED
ILLINOIS STEEL CO DIST 22,000 EMPLOYED
LAKE CALUMET
WOLF LAKE
WHITING 1,817 EMPLOYED
WEST PULLMAN AREA 8,000 EMPLOYED
EAST CHICAGO 7,995 EMPLOYED
BLUE ISLAND 3,675 EMPLOYED
HARVEY 3,638 EMPLOYED
CALUMET CITY 1,692 EMPLOYED
GARY 12,875 EMPLOYED
CHICAGO HEIGHTS 5,182 EMPLOYED
HAMMOND 9,564 EMPLOYED
ILLINOIS
INDIANA
PREPARED BY ALLEN C WILLIAMS
SECRETARY ILLINOIS STATE PLANNING BOARD

FIGURE 1.—Distribution of jobs in principal employment areas, Chicago and environs, 1935.

Three-fourths of the jobs are widely distributed in the metropolitan area; one-fourth are situated "downtown," and diffusion outward continues. At present many workers live long distances from their work, and "cross-hauling" in all large cities constitutes a great drain in time, energy, and money. The redistribution of housing in relation to employment can be fostered in the planning of housing developments.

Less than half of the 55-square-mile downtown "blighted area" in Chicago could accommodate 300,000 to 400,000 families at a density of 20 families per net acre, or less. Accordingly, all downtown workers who chose to live close in could be accommodated in a relatively open development, if the rebuilding were planned to meet the need rather than to support the "expectation value" of property.

Within metropolitan areas houses may be built in slum and blighted locations, or on vacant lands inside of or immediately adjacent to the city or its suburbs, or on new, totally undeveloped outlying suburban sites. While these three types of location are often not sharply defined on the ground, they do represent the three broad categories among which a choice must generally be made for every house-building project, and the location problems are clarified by analyzing them in this way.

We deal here mainly with the period of the next 15 or 20 years. While present projects should provide houses which will continue to be habitable throughout their physical life, the formulation of policies and programs beyond the next decade or two is obscured by relatively unpredictable changes in purchasing power; in the distribution of industry; in the distribution and rate of increase of the population; in transportation; in techniques of building construction; in the physical, social, and governmental organization of urban and metropolitan areas; and in the responsibilities of government. We can, however, in the light of present knowledge, reasonably attempt to understand the situation of the present and of the relatively early future—the period during which the enormous current housing shortage will probably be met through various activities.

Like other factors, the location for housing becomes a problem only when considered in terms of cost and of "livability," in terms of meeting the monthly costs which the lower-income half or two-thirds of the urban population can pay and at the same time providing at least the minimum American standard of healthful, convenient shelter.

Influence of Location Upon Cost and Quality of Housing

It should be made clear that the term "cost of housing" is used here to mean the total annual or monthly cost, including interest and amortization on the investment, commissions and mortgage insurance, full normal taxes, maintenance and normal replacements, management, the utility services (water, electricity, gas), heating, and special assessments for such items as street paving and sewers. For certain computations there has also been included the cost of essential transportation paid out of pocket for going to and from places of employment, this element being always important in determining location, and often controlling the choice of site. In this way, we can most readily discover the relationship between the factors of location and the other factors which make for greater or lesser costs and desirability.

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[3] From the 1930 *Census of Population:* Metropolitan districts, population 54,753,645; all other incorporated places above 5,000, population 9,483,588.

[4] National Resources Committee, *Our Cities.* Government Printing Office, 1936, p. 33–35.

In considering the first cost of the land itself, there is included the cost of those local improvements which go to make the land "ready to use"—the street pavements, water mains, sewers, street sidewalks, etc.—the elements which are ordinarily included in the purchase price of an unincumbered lot ready for the building operation.

Land in metropolitan regions, ready to use for houses, at the present time generally ranges in purchase price from $2,000 to $200,000 per net acre. The lower limit represents the category of outlying vacant land with very modest street improvements; the upper range represents the category of sites in densely occupied sections of the large cities. Generally, the outlying lands have been considered too remote to attract the multitudes. The price of close-in lands reflects the complex of beliefs that almost all such sites can be and will continue to be used for commercial operations and for crowded apartment houses and tenements. Improvement in transit facilities and the suburbanization of commerce and industry are destroying the basis for these beliefs.[5] Meanwhile, the high prices put upon close-in land constitute a controlling element in the sequence which produces slums and retards their reconstruction on livable standards.

By virtue of the fact that, in nearly all residential construction, the number of house units placed on the land increases more or less proportionately with the purchase price of the site, the cost of the land per dwelling falls within a much narrower range.

The first cost of land, ready to use, traditionally constitutes from 10 to 25 percent of the total capital cost of the complete, unfurnished housing unit. For single-family houses, which still make up the great preponderance of urban dwellings and of residential construction in the United States, developers consider that the lot ready to use should properly represent in the neighborhood of 20 percent of the total cost of the house and lot.

Correspondingly, the capital charges on the cost of the site represent something in the order of 10 to 25 percent of the total capital charges, although this ratio is often obscured by the widely varying manner in which the cost of land is written into a house-building project.

When we consider the portion of *total monthly cost* which goes to pay the fixed charges on the first cost of the land, the showing is quite different, since the capital charges represent only part of the total monthly cost.[6]

TABLE I.—*Per-family cost of land ready to use, expressed as an approximate percentage of total first cost of land, building, and landscaping*

Type of development:	*Percent*
Private small house-and-lot development	15–25
Tenement development on "$2 land" at 60 families per net acre and $4,500 per-family building cost	25
Milwaukee P. W. A. housing project, Parklawn	10
Milwaukee suburban resettlement project, Greendale	20
Detroit P. W. A. housing project, Brewster (slum clearance)	14
A large-scale middle-class project in Washington, D. C., district	19

Thus, if capital charges constitute half of the total monthly cost, and taxes, maintenance, utilities services, heat, etc., the other half (the ratio varies from 30–70 to 70–30), and if capital charges on the land ready to use represent 15 percent of the total capital charges, the "monthly land cost" amounts to only 7½ percent of the total monthly cost. By loading twice as many families on the same land area, this step, considered by itself, will reduce the total monthly cost per family by less than 4 percent. This elementary computation is fundamental in housing economics.

Cost of utilities services.—The monthly cost of electricity, water, gas, garbage collection, etc., varies in different locations. There is no general rule to guide in selection of a site, but the facts should be gathered and set in with the other cost figures. The quality of these services also varies widely. For example, a relatively cheap, hard water is often both inconvenient and expensive to the householder, who must soften it with a domestic softener or with soap. The type of housing project also influences the cost and quality of these services, and, as discussed later, the location of a project critically affects the type of housing. The P. W. A. Housing Division and the Suburban Resettlement Division of the Resettlement Administration generally procured relatively very low rates for electricity purchased at wholesale and distributed on an unmetered basis. The low rate, in turn, makes it possible to take advantage of the great convenience of electric cooking stoves and other electric household appliances. By and large, utilities services are likely to be less expensive when taken from existing municipal plants than when taken from facilities newly developed for totally detached sites.

Taxes.—Taxes and taxation policy vary widely in different locations. Again, there is no general guide except the suggestion that the taxes (not the tax rate) and the quality of the governmental services be entered into the computations by which total monthly cost and quality finally dictate the choice of a site. Sometimes prevailing tax rates are deceptive. A low State and local public debt and relatively high taxes may be more favorable over a period of years than the converse, which some day will require higher taxes to clear up the debts. The suburban towns are probably most favorable from the standpoint of current tax costs; the new isolated small garden suburb probably faces the highest tax costs for equivalent services.[7]

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[5] For a summation of many recent studies see *Our Cities*, National Resources Committee, Government Printing Office, June 1937.

[6] In formulating housing programs it should be constantly emphasized that a reduction in capital cost translates itself into monthly saving at only the interest and amortization rate applied to the capital saving, while economies in maintenance, transportation, heat, etc., represent equivalent direct savings in monthly cost. Further, cheaper construction requires more maintenance and may be more costly per month.

General community costs.—A large and increasing portion of our earnings from productive labor goes to carry the costs of governmental and community services. These community costs include governmental administration, police and fire protection, health and hospital services, correctional and charitable institutions and agencies, education, recreation facilities, maintenance of the vast physical plant which is operated by our government, and many other items. The manner in which a metropolitan district is built up vitally affects all these costs, quite apart from the other elements of efficiency or waste in community operation. This is an extremely complicated matter, but two major elements will illustrate its over-all potency.

It seems to be established as a fact that slum living conditions contribute to the public and private costs required to meet ill health, delinquency, crime, unproductiveness, fire losses, etc., all in part attributable to the relatively dark, crowded, insanitary housing in such areas. It is probably not possible to isolate the proportion of these costs which is due to the slum housing and the proportion which would not be eliminated by the substitution of good housing, for disease, delinquency, crime, etc., are common manifestations of poverty, wherever housed. Further, the showing that slum districts carry in tax yield less than their share of governmental service costs is not conclusive, since the tax yield is most directly a function of the capacity of slum dwellers to pay, wherever and however housed. Nevertheless, the slums themselves are a real community liability, and the building of more slums will inevitably increase the liability.

Thin, scattered development also is expensive for the community. Even if the houses themselves are altogether satisfactory, the overextension of streets and utilities and of the police, fire, educational, recreational, and health services costs more in the outlay of public funds per family than does a more continuous development which utilizes the public facilities more fully.

From this standpoint, and in the light of our present knowledge of efficient city building, the optimum pattern is that represented by a density of population in the range of 10 to 25 families per net acre of built-up residential area, with perhaps one-third to one-half of the gross built-up urban land area devoted to streets, parks, public institutions, industry, and commerce.

Here we encounter an important consideration. Our metropolitan districts are now physically so organized that, by and large, the basic services are spread out to accommodate, within the areas now served, the whole metropolitan population, at densities not greater than those tentatively quoted above as an optimum. Only minor additional areal expansion of the public services is required to provide sites for all present and prospective metropolitan populations, at an approximate density of 20 families per net acre.

It may be asserted with some confidence that, with few exceptions, no permanent community economies will be achieved by low-income residential development either above or below the range of 10 to 25 families per net acre of built-up area.

On available 10- to 50-cent land and in the density range quoted, the land cost per unit is low, the appropriate type of development permits relatively inexpensive construction per unit of livability and a high degree of tenant maintenance, which is very important, and the general community costs will tend to be favorably affected.

All told, general community costs are high, and they are rising, particularly in metropolitan areas. Two most important measures to check the continued rise of these costs and to bring them back into balance are mature metropolitan regional planning and well-considered programs for new low-income housing at rational densities on the land.

Interest charges.—In slum and blighted neighborhoods, interest charges tend to be higher and amortization periods shorter than in new, open districts. The zoned, restricted, apparently stable residential district, with satisfactory utilities and transportation service, is usually least costly in interest and amortization. This is a matter of considerable importance. A reduction of only 1 percent, say from 6 to 5 percent, in the annual charges for interest and amortization effects, in the typical situation, a larger saving in monthly cost than can be made by doubling the number of families on the site in order to reduce by 50 percent the original land cost per family.

Transportation costs.—The monthly cost of going to and from work varies with the location of the residence in relation to places of employment, and, for families with incomes up to $1,600 per year, ranges from little or nothing up to about $10 per family per month. Reducing the first cost of a house and lot from $5,000 to $4,000, at 5 percent per year for interest and amortization, saves only $4 per month on capital charges. A saving of 15 cents per day per family in average transportation costs is approximately equivalent.

One extra mile of auto haul, at 3 cents per mile, and at an average of one and one-half round trips per day per family, costs $27 for a 300-day year, which, capitalized at 5 percent, is equivalent to a capital investment of $540. In other words, on this basis, the cost of land ready to use for housing could be $540 more per family if it avoided 1 extra mile of automobile travel.

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[7] Until such time as they are further developed, the curtailed suburban resettlement projects, with only 600 to 900 families, must necessarily carry heavy taxes to meet the cost of the community public services.

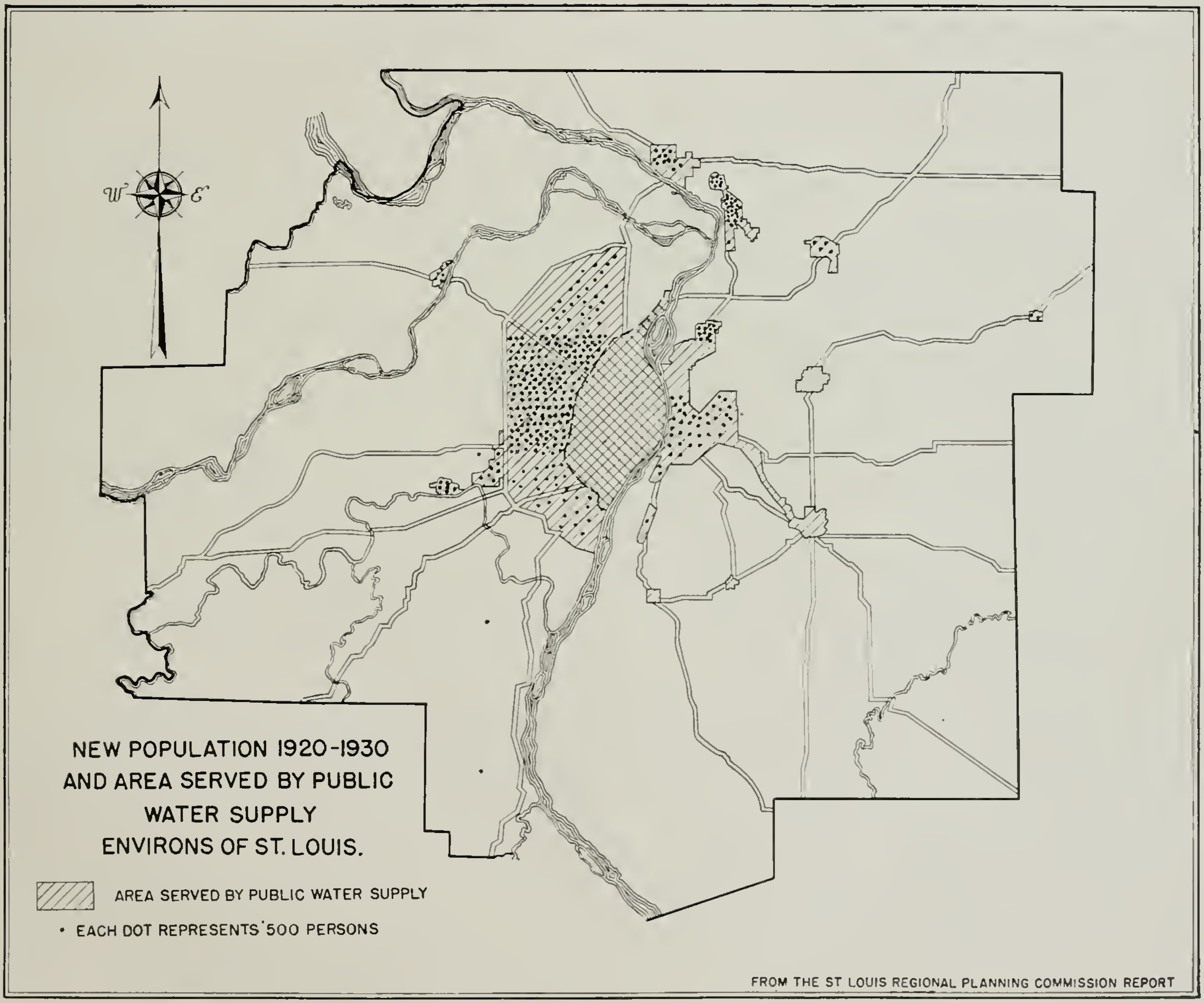
The time, cost, convenience, and relative agreeableness of transit constitute controlling factors in metropolitan growth and in housing programs. The development of rapid transit, the automobile, the elevated highway, and the freeway are potent forces in the spread of industry and of housing in metropolitan areas. They are rapidly reshaping our cities. They are slowly recasting land values in older sections.

Building codes.—Big city building codes tend to be more restrictive and more "political;" and, accordingly, housing located in suburban areas can sometimes be built less expensively, without violation of good standards.

Wage rates.—Likewise, wage rates tend to be lower in some suburban areas than within the large cities. While it is not considered that the solution of the housing production problem lies in reduced annual building-trades wage rates, it is nevertheless true that, where living costs are lower for construction workers who live in the outer portions of metropolitan districts, wages may also be lower without sacrifice by the worker.

Fire insurance constitutes a minor item. The rates are generally lowest in suburban towns and higher in congested areas and in undeveloped areas without adequate fire protection.

Delivery of materials, an element in the cost of building, is generally less costly outside of the congested areas but more costly again in isolated sections at a distance from railroad service.


W
E
NEW POPULATION 1920-1930
AND AREA SERVED BY PUBLIC
WATER SUPPLY
ENVIRONS OF ST. LOUIS.
AREA SERVED BY PUBLIC WATER SUPPLY
• EACH DOT REPRESENTS 500 PERSONS

FROM THE ST LOUIS REGIONAL PLANNING COMMISSION REPORT

FIGURE 2.—New population 1920–30 and area served by public water supply, environs of St. Louis.

Extension of public water supply helps to make possible the diffusion of residential development outside the central city but within the metropolitan area.

Relationship between location, type of housing, and costs.—In rounding out the examination of the influence of location upon the cost and quality of housing, we return to some of the points raised at the beginning of this section. The price paid for the land ready to use in considerable measure dictates the type of housing provided and, in turn, the monthly costs and the livability of the houses. As the cost of the land goes up, the developer seeks to compensate by reducing the other elements of cost. On high-priced land he turns to the apartment house or the tenement. By so doing, the first cost of the land and the capital charges on the land per family are reduced. Then it is discovered that "fire resistant" construction may be required for multiple dwellings, adding to building cost; and that halls and stairways and heating plants and grounds require more project maintenance than for the tenant-operated or owner-operated dwelling unit, adding to the operation costs. At once, the tendency is to cut down the size of the apartment, cut down the size of halls and stairs, cut down the area of open ground, put in stove heat—critically to reduce standards and livability, without actually reducing the total monthly cost proportionately. Private developers realize this impasse into which they are led by high-priced land, and, with industry moving outward and transit facilities rapidly improving, the very great preponderance of privately built housing goes out to less expensive locations.

For low-income housing there are usually other more economical alternatives than that of piling apartments up on high-priced land.

Comparing Three Types of Location

As an illustration of the weight of the factors of location, there follows a computation on hypothetical projects in each of three principal categories; a slum site, a site on vacant land within or adjacent to a city in the metropolitan region, and an outlying vacant suburban site where no development existed previously. The choice generally lies among these three types of location, or variations of them.

(*a*) A slum site at $1.50 per square foot ready to use; two and three-story apartment houses, fireproof, averaging four rooms per unit; 1,600 square feet of net land area per family; central heat and hot water; wholesale electricity; walk to work; considerable community maintenance of grounds.

(*b*) A site on the outskirts of a sizeable central city; land, ready to use, at 25 cents per square foot of net area; single, twin, and row houses of frame or masonry, average five rooms each; lots at 4,000 square feet per family; reservations for playgrounds, etc.; individual furnaces and hot-water stoves; wholesale electricity; $5 per month per family for necessary travel; occupant maintenance of yards; utilities service from municipality and companies.

(*c*) A farm-land site converted into a new garden suburb community of 1,200 families, with area reserved for expansion; land ready to use at 15 cents per square foot of lot, and at 5,000 square feet per family; single and twin houses of frame or masonry, averaging five rooms each; furnaces and hot-water stoves; wholesale electricity; occupant maintains yards; 5 miles to work by bus or by car on freeway and elevated highway at $10 per family per month; new water supply, sewage-treatment and garbage plants necessary; schools and stores provided as part of project.

In this table, round figures are used throughout to dispel any implication that the computation is precise. It is not. It is set up on a purely hypothetical basis with approximate values to illustrate the way that the factors weave together and the way location should be determined by considering all aspects of a project.

No general conclusion can safely be drawn from this table, except that, in selecting a location, the alternatives must be considered by figuring the whole job through, at least in a preliminary way. The location factors weave through the whole complex of costs and livability, and lower or higher land cost per family does not necessarily of itself produce lower or higher total monthly costs to the occupant.

TABLE II.—*Hypothetical illustrative cost of 3 types of housing*

Elements of cost	Slum site, 1,600 square feet, 4-room apartment	City-outskirts vacant site, 4,000 square feet, 5-room house	Converted farm-land site, 5,000 square feet, 5-room house
1. Cost of land ready to use, per family [1]	$2,400	$1,000	$750
2. Cost of housing unit, excluding land [2]	5,000	4,800	5,000
3. Interest and amortization, 5 percent on 1 plus 2, per month [3]	31	24	24
4. Full taxes, per month [4]	14	10	12
5. Project maintenance of buildings and grounds, and fire insurance, per month [5]	12	10	10
6. Water, electricity, and hot water, per month	4	4	4
7. Heat, per month	4	5	5
8. Transportation, per month	----------	5	10
Total cost per month	65	58	65

[1] While 1,600 square feet of net land area (about 27 families per net acre) is a lesser density than $1.50 land usually produces, good feasible standards and rational city building dictate densities in the range assumed here. Increasing the density on this land, say up to 50 families per net acre, would decrease the first cost of the land per family, it might slightly decrease construction costs, and it would tend to decrease the cost of project maintenance of grounds. The total monthly cost would then be in the range of the city-outskirts vacant site, but the livability would be, for most families, considerably less. Thus, the point is emphasized that $1.50 land is generally too expensive for low-income housing, unless public subsidy goes to "pay out" the excess of land cost. Private low-income housing does not generally use such costly land; public housing policy revolves in part around the question of whether expensive built-up blighted areas should be utilized.

[2] The cost per housing unit varies widely, but it is a fact that the first cost of a 4-room fireproof apartment, with corridors, central heating plant, etc., lies in the same range as the first cost of 5-room semifireproof cottages, twin houses and row houses.

[3] Interest and amortization are figured at a uniform hypothetical rate on land and structure equally. Both the rate and the application of the rate to land and to buildings will vary in different situations.

[4] Full normal taxes are figured at about 2.2 percent on total capital cost for the slum site, at about 2.0 percent for the vacant site on the outskirts of a central city, and at about 2.4 percent for the garden suburb, where a new village must sustain its separate services.

[5] Structural maintenance is favorable to the slum site, but in the 2 vacant outlying sites maintenance of halls, walks, and grounds is assigned to occupants, compensating in the total monthly cost.

The most important thing revealed in this appraisal of types of location is that crowding the buildings together and upward on expensive land usually does not proportionately reduce monthly costs, whereas it may reduce in a marked degree the livability qualities desired by the families to be housed.

At this point, we face the intricate question of the preferences for different types of housing on the part of the families in the income ranges here considered. Tradition, the results of various questionnaires, and, most significant, the response of private developers to the market, all indicate a predominant desire for the house (cottage, twin house, or row house) in preference to the apartment.[8] Nevertheless, the relative convenience of apartment living, with heating and much of the operation and maintenance supplied by the management, may begin to turn the tide for some proportion of these families. Again, the location factors in housing have to be considered in the light of these changing preferences.

The Optimum Location for Housing

Drawing from the considerations which have been briefly reviewed, it is possible to enumerate the characteristics which together help to identify an optimum location for metropolitan housing to accommodate families in the lower income ranges.

1. Preferably within walking distance from major areas of employment, or, if beyond walking range, within a maximum of 30 minutes in time and 10 cents in cost each way for transportation. Here it should not be forgotten that the 5-mile trolley ride usually costs no more than the 1-mile ride, and may require only 25 minutes as compared with 15 minutes for the 1-mile trip; that the "jitney," carrying two to five men or women who divide the cost, is both increasing in popularity and decreasing in cost per person; and that improved transit facilities, elevated highways and freeways are rapidly extending the area served within the range of 30 minutes and 10 cents.
2. Within half a mile of adequate grade schools and local shopping facilities, existent or shortly to be provided. Playgrounds should be available within a quarter mile of every house.
3. Accessible to a good water supply, sewers, and electricity at reasonable cost.
4. The cost of the land ready to use should permit a suitable type of development. The optimum, all things considered, will permit single-family houses, twin houses, row houses, and small apartment houses at densities ranging from 8 or 10 to 20 or 25 families per

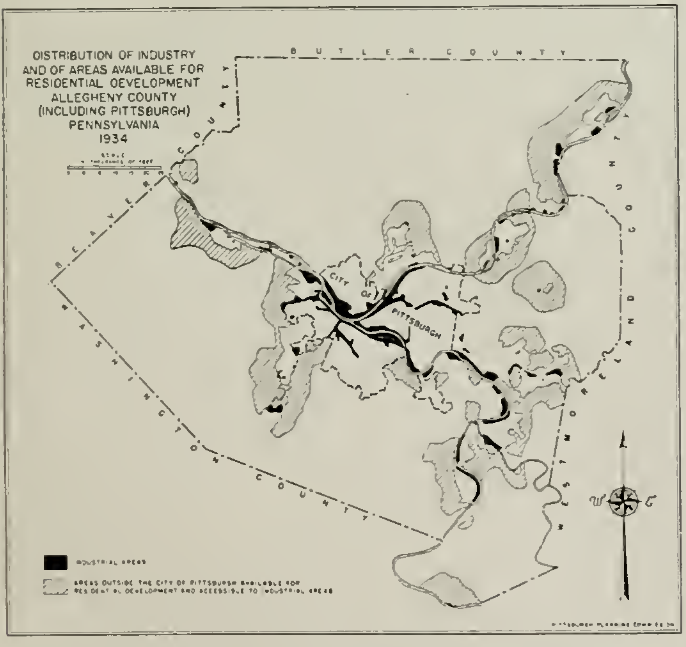


FIGURE 3.—Distribution of industry and of areas available for residential development, Allegheny County (including Pittsburgh), Pa., 1934.

Industry diffuses into the metropolitan region; residential development for workers tends to follow. Such movement of industry and housing is characteristic of large centers in the United States.

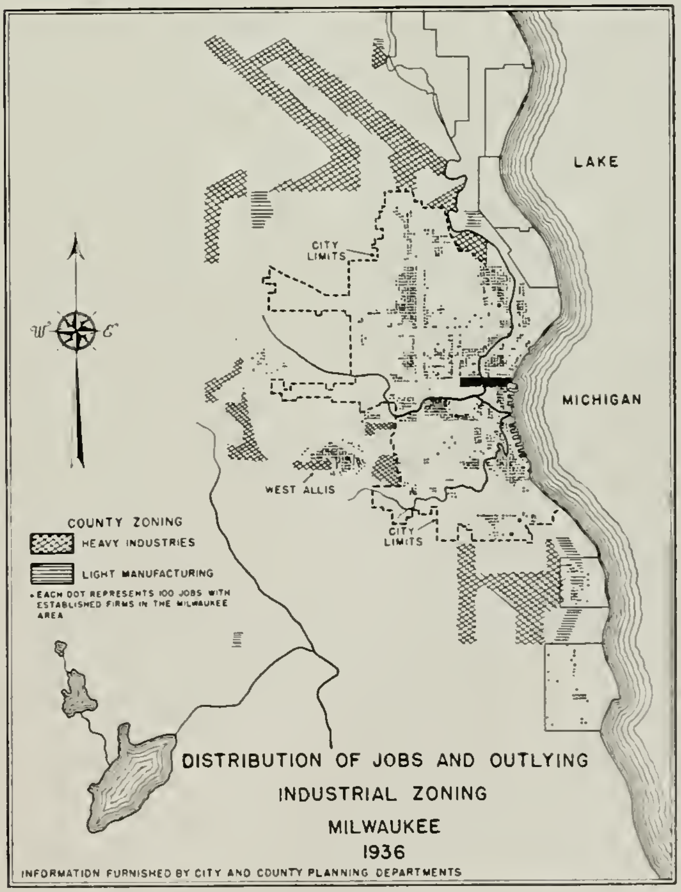

LAKE
MICHIGAN
CITY LIMITS
CITY LIMITS
WEST ALLIS
W
E
COUNTY ZONING
HEAVY INDUSTRIES
LIGHT MANUFACTURING
• EACH DOT REPRESENTS 100 JOBS WITH ESTABLISHED FIRMS IN THE MILWAUKEE AREA
DISTRIBUTION OF JOBS AND OUTLYING
INDUSTRIAL ZONING
MILWAUKEE
1936
INFORMATION FURNISHED BY CITY AND COUNTY PLANNING DEPARTMENTS

FIGURE 4.—Distribution of jobs and outlying industrial zoning, Milwaukee, 1936.

In this, and in nearly all metropolitan areas, the outlying zoning for industry anticipates the outward movement of industry.

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[8] The Illinois State Housing Board estimates that more than 97 percent of all the dwelling units constructed during 1936 in the Chicago metropolitan area were single-family houses.

net acre and net land coverage ranging from around 15 percent for occupant-maintained private yards up to a maximum of 25 to 35 percent where the ground may be partially project-maintained. In general, the cost of optimum sites ready to use will range from $4,000 to $12,000 per net acre, or from 10 to 30 cents per square foot of net land area with street and utility installation costs included.

5. The neighborhood stability should be such as to create lowest risks of neighborhood deterioration and hence, on this score, to justify lowest rates of interest and amortization. Here, regional planning, municipal and county zoning, deed restrictions, and effective regulation of subdividing are of great importance.

6. From the standpoint of the whole metropolitan community, housing projects should be so located as to promote and not obstruct the development and redevelopment of a satisfactory regional city; promote municipal and regional economy; promote and not obstruct the execution of civic development projects such as parks and highways; promote and not damage neighboring development; facilitate the demolition of slums and not create new ones; place the occupant families in a geographic situation where they may participate conveniently and fully in the life and responsibilities of the region and of their social group. This is to say that housing should be part and parcel of well-considered metropolitan regional planning.

The Slum and the Garden City

Against these broad criteria for the optimum location we may briefly appraise the two extreme situations—the slum site and the new garden city or garden suburb.

It is safe to assume that unsubsidized private capital will not generally go in to clear slum lands and build low-income housing on them, at any rate not until the cost of such sites has fallen sharply. Further, it is a safe assertion that generally, all things considered, there are no longer any controlling factors of public policy which dictate the continuance of the dense concentration of population which characterize most close-in city slums. Accordingly a principle emerges. The clearance and rebuilding of expensive slum areas by public agencies is wise only if it is justifiable to write off, as a subsidy to the ramified interests which own the slum property, the difference between the purchase price and the land cost which the new housing project can reasonably carry.

The slums in our cities are already recognized as constituting large areas, and as time goes on they will be considered to include still larger areas. They are in fact the product of age, change, and city growth. They constitute community liabilities and, often, private liabilities. In slum districts the "invested value" has often long since been amortized out of existence by rents paid. The current pressure to put public monies into bailing them out does not of itself make them appropriate locations for housing. Their populations are leaving them for very good reasons, and their present market values are sustained largely by illusions of a prospect for realizing upon those values. The regional city ahead of us will not, cannot, revert to the crowding of human beings and industry which characterizes the slums and make them slums. By and large, the public interest will be best served if slum districts are considered to be worth for housing not over something in the order of 50 cents per square foot of net land area ready to use, and if the values above such a figure are permitted to wear themselves down to real use values by encouraging rather than discouraging their partial abandonment.

The garden city or garden suburb represents the closest thing to the ideal that has been proposed in metropolitan regional development, provided the other criteria are met. The principles of the garden city contemplate that there be taken a large tract of relatively undeveloped, inexpensive land in a good location within the metropolitan region; that a development of industry, housing, and community facilities be planned and carried out as an integrated whole; that an appropriate, large part of the land area be reserved for parks, forests, and farms; that the community, by one arrangement or another, receive the benefit of the increment in economic land value created by the development of the area; that maximum size be limited to that which produces the optimum local community life, perhaps 50,000 population. The garden suburb differs from the garden city mainly in that it contemplates a residential community conveniently related to major employment areas outside its own boundaries. In the English-speaking world, Letchworth and Welwyn, near London, are the classic examples of the garden city. In the United States a number of developments fall more or less in the category of garden city or garden suburb; the "Greenbelt" projects of the Resettlement Administration are the most recent. Drawing upon earlier ventures and upon the experience of the Suburban Resettlement Division[9] of the Resettlement Administration (now the Farm Security Administration), some salient points may be brought to bear upon the whole problem of location for housing. The garden city and garden suburb theory is an excellent one and susceptible of use in this country. The garden city is preferable to the garden suburb, but more difficult (perhaps only rarely feasible) because of the lag in the industrial-employment base and tax base in a new location. The garden suburb has an advantage in that it may detach itself from railroads and main highways, where topography, land costs, and existing development and subdivisions all militate against the prospect of acquiring a large enough tract of suitable land. Further, since Ebenezer Howard first formulated the English garden city principles, about 1898, transit and automobile developments have freed residential settlements from the earlier necessity of immediate proximity to industry.

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[9] These are the writer's comments and in no way represent the official conclusions of the Administration or the Division.

A garden city or garden suburb development requires that the agency responsible for it should have the means to build up to a minimum of some 1,200 families in the first project. The capital costs and the operation costs per family for good, standard facilities for water supply, wastes disposal, recreation, police and fire protection, and, notably, education become disproportionately high for the small new village; and a settlement of less than 1,200 families faces critical difficulties in the cost of supporting even minimum standards in these public services.

If not incorporating sufficient employment opportunities within its area, the garden suburb must be situated within economic travel distance for the residents to go to and from established and prospective areas of employment. This is not difficult except for the fact that around our big cities a great part of the most eligible lands are already subdivided and, even though not built up, are troublesome and costly to assemble in a large enough tract.

If the purchase price of the virgin land is in the range of $300 or $400 an acre, then the portions to be built up can be planned so that the capital cost of the utilities is in proper proportion ($500 to $1,000 per residential unit), and from half to three-fourths of the total tract can be devoted to a green open environment and a protective belt of parks, parkways, forests, and farms.

The primary step is that of securing the land (from 600 to 800 acres, as a minimum, upward to many thousands as the ideal), carefully planning all the future development as a whole, and proceeding with at least the first development unit of 1,200 dwellings or more.

The garden city or garden suburb will fare best if it is recognized throughout that various income groups and occupational groups are advantageous to well-rounded community life. While loyalty and cohesion within the development are desirable, the arrangements should encourage the participation of the residents in the larger life of the metropolitan region.

Aid from the Federal Government in the purchase of the necessarily large tracts of land would greatly facilitate the production of housing in the form of garden cities and garden suburbs. Where feasible, such developments, conveniently situated and wisely planned, represent the all-around ideal in location for a portion of low-income housing in metropolitan regions.

The Availability of Appropriate Land for Housing

Having examined the influence of location upon the cost and livability of housing, and having suggested the criteria upon which alternative locations can be appraised, we may now look into the question of the availability of lands which meet the more important criteria. The accompanying figures illustrate the American metropolitan region—crowded at the center; development stringing out along main arteries of transportation; the land, in much the larger part, open, vacant, and idle insofar as urban uses are concerned. A most significant trend in development for the past 50 years or so has been outward into the suburban fringe. Stimulated by congestion and high costs downtown and by the steady improvement of transit, highways, and the automobile, industry, commerce, and housing have begun a great outward push. New patterns of development, a new distribution of land uses and of population, and new areal economic and social relationships are emerging.

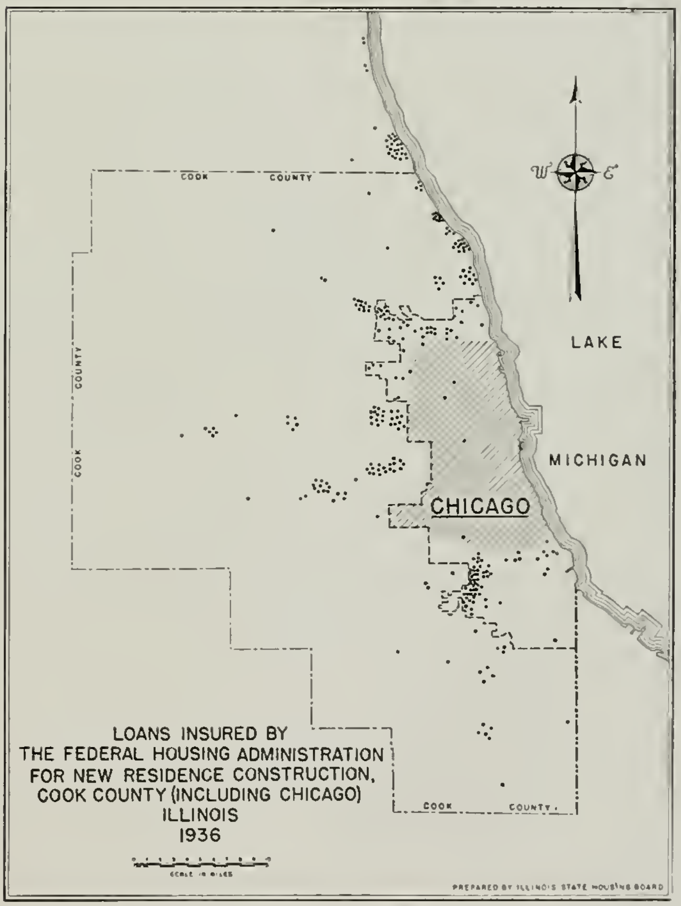

COOK
COUNTY
W
E
LAKE
MICHIGAN
CHICAGO
LOANS INSURED BY
THE FEDERAL HOUSING ADMINISTRATION
FOR NEW RESIDENCE CONSTRUCTION,
COOK COUNTY (INCLUDING CHICAGO)
ILLINOIS
1936
SCALE IN MILES
PREPARED BY ILLINOIS STATE HOUSING BOARD

FIGURE 5.—Loans insured by the Federal Housing Administration for new residence construction, Cook County (including Chicago), Ill., 1936.

Only three loans were insured by Federal Housing Administration within the main portion of the city of Chicago; almost all were outlying in Chicago and its suburbs. The great bulk of this type of residential building seeks outlying situations.

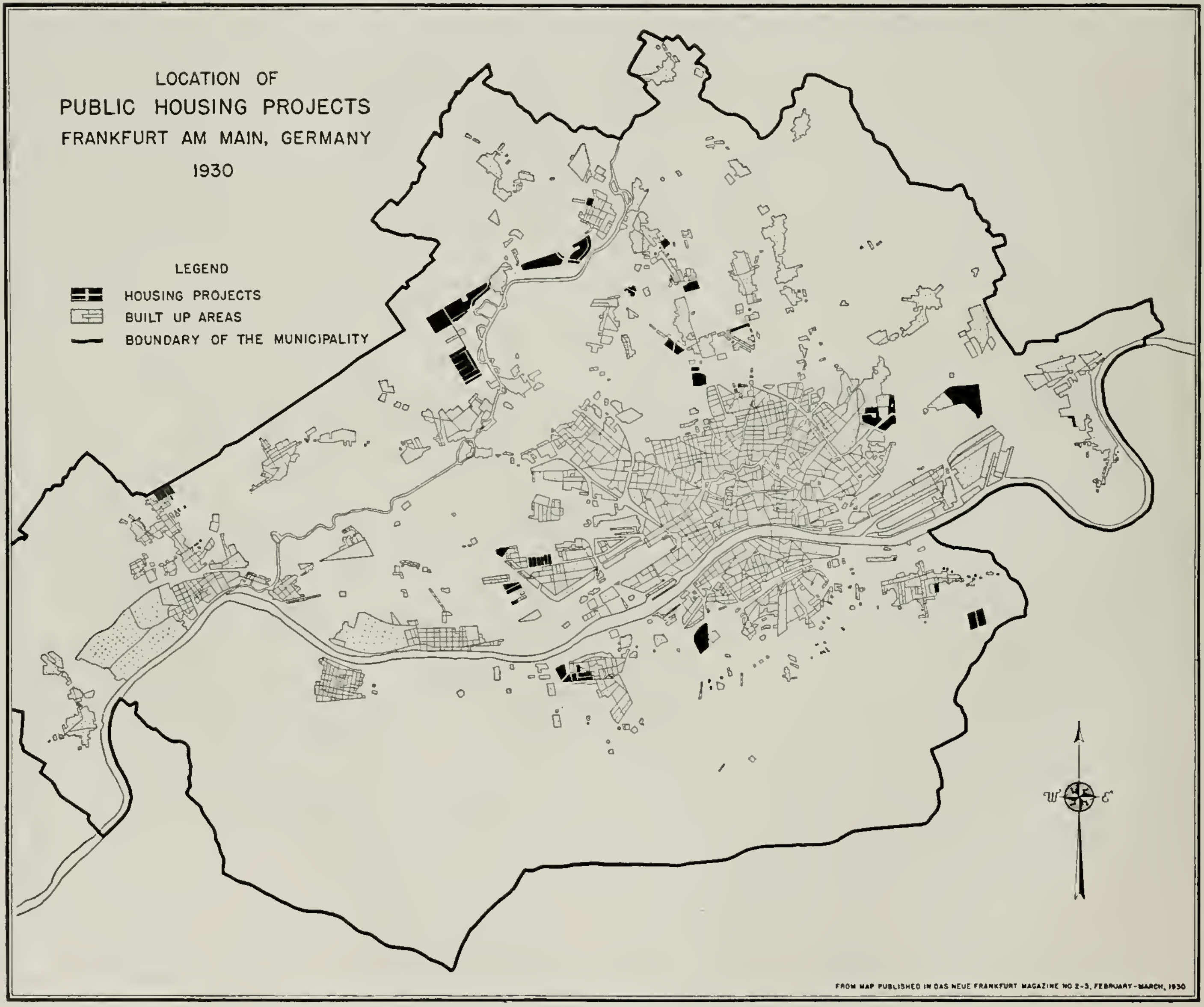
Every house builder considers the location factors which we have brought out; and, while a complete and competent analysis is rarely made, the rational conclusions and the hunches on which decisions are based have placed the bulk of new private housing during recent years in the outlying parts of the metropolitan cities and in their suburban towns.

In that part of the Chicago metropolitan region lying within the State of Illinois, during the calendar year 1936, estimates furnished by the Illinois State Housing Board show that, of 2,100 residential units constructed, about 60 percent were built in the suburbs and about 40 percent in the city of Chicago. Of 377 mortgages insured by the Federal Housing Administration in the same area during 1936, 374 were mortgages on property situated in the far outer fringes of the city and in the suburban ring. (See fig. 5.)

Table III.—*Location of Public Works Administration projects, 1937*

Location	Number of projects	Percentage of projects	Number of dwelling units	Percentage of dwelling units
On slum-cleared land	26	48	13,004	53
Close-in on vacant land	13	24	4,468	18
On vacant city-fringe land	15	28	6,940	29
Total	----------	100	----------	100

Public housing has probably been more highly rationalized, both in the United States and abroad, and it has been directed toward social purposes rather than profits.



FROM MAP PUBLISHED IN DAS NEUE FRANKFURT MAGAZINE NO 2-3, FEBRUARY-MARCH, 1930

Figure 6.—Location of public housing projects, Frankfurt am Main, Germany, 1930.

In almost all European cities, the great preponderance of public housing is situated outlying.

The current (1937) projects of the Housing Division of the Federal Emergency Administration of Public Works within the continental United States (including limited-dividend projects), show a distribution in location categories as in table III.

The three suburban resettlement projects of the Resettlement Administration (now the Farm Security Administration) are located well outside the built-up urban areas but well within the metropolitan regions of Washington, Cincinnati, and Milwaukee.

A rough approximation seems to indicate that in western Europe at least 80 percent of all public housing of the past 30 years is situated on outlying sites, and only 20 percent or less on close-in slum sites. (See fig. 6.)

Now, both tradition and public policy in the United States have dealt with urban land as a commodity. Far in advance of the need, the subdividers, with the enthusiastic cooperation of the press, and with little discouragement from government, have platted and offered for sale a constant oversupply of building lots. The process all told constitutes a major catastrophe. For the purpose at hand, the chief result is that much (in some metropolitan districts almost all) of the land most suitable for house building has been temporarily lost. It is bogged down in a complex of unpaid purchase contracts, delinquent taxes and special assessments, and wastefully planned recorded plats.

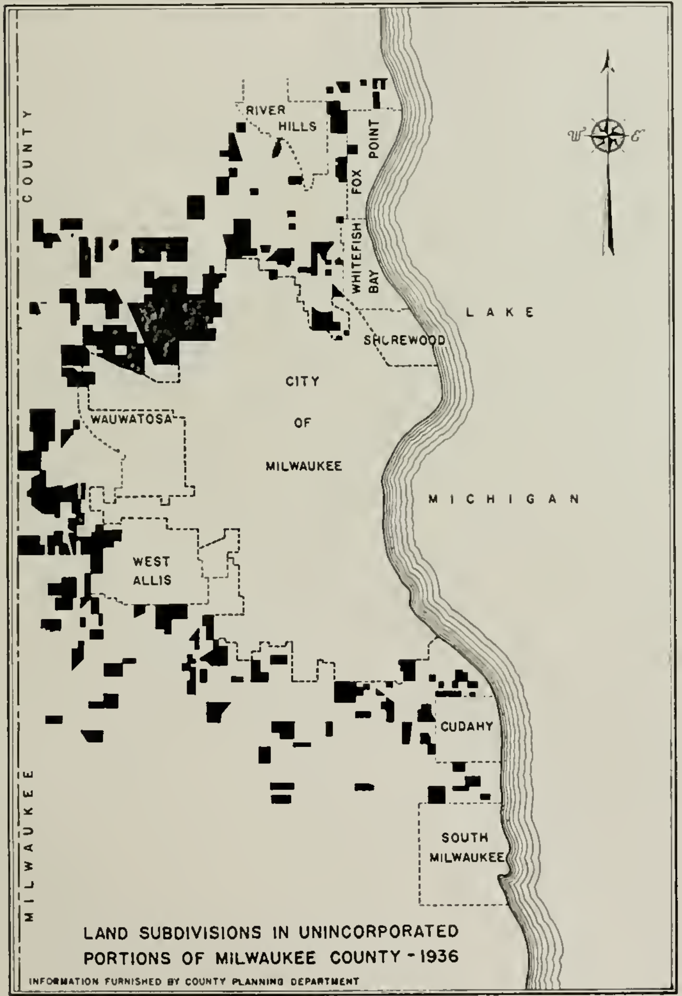


FIGURE 7.—Land subdivision in unincorporated portions of Milwaukee County, 1936.

Milwaukee County is relatively free from "wild-cat" subdividing. Nevertheless the open countryside is cut up by premature subdivisions. Similar and often more aggravated situations in metropolitan areas greatly complicate the problems of municipal development and locations for housing projects.

For any long-range metropolitan housing program, these lands must be at least in part extricated from their present impasse. Millions of lots and billions of dollars are involved. Government will have to intercede more vigorously than hitherto, and, through government, the public will probably have to bear a good part of the enormous losses which are entailed.

No single formula can be given to treat all cases. Each defunct subdivision represents a separate and distinct problem. However, in each of the States a search for the solution will lead to municipal and State legislative and administrative provisions to deal with the situations as they are found to exist.

In Europe, notably in Scandinavia, Holland, and Germany, the problems of directing land subdividing into sensible channels have been matters of public interest and public management for a long time.

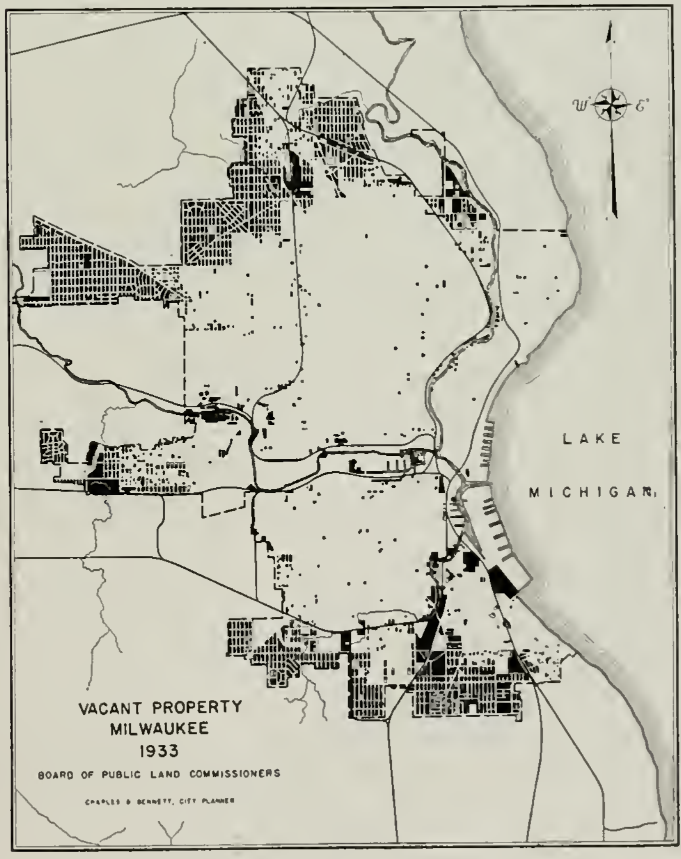

W
E
LAKE
MICHIGAN
VACANT PROPERTY
MILWAUKEE
1933
BOARD OF PUBLIC LAND COMMISSIONERS
CHARLES B. BENNETT, CITY PLANNER

FIGURE 8.—Vacant property, Milwaukee, 1933.

Relatively orderly expansion; much vacant land now accessible to municipal services and utilities. Such lands are available for housing. This situation prevails in greater or lesser degree in most American cities.

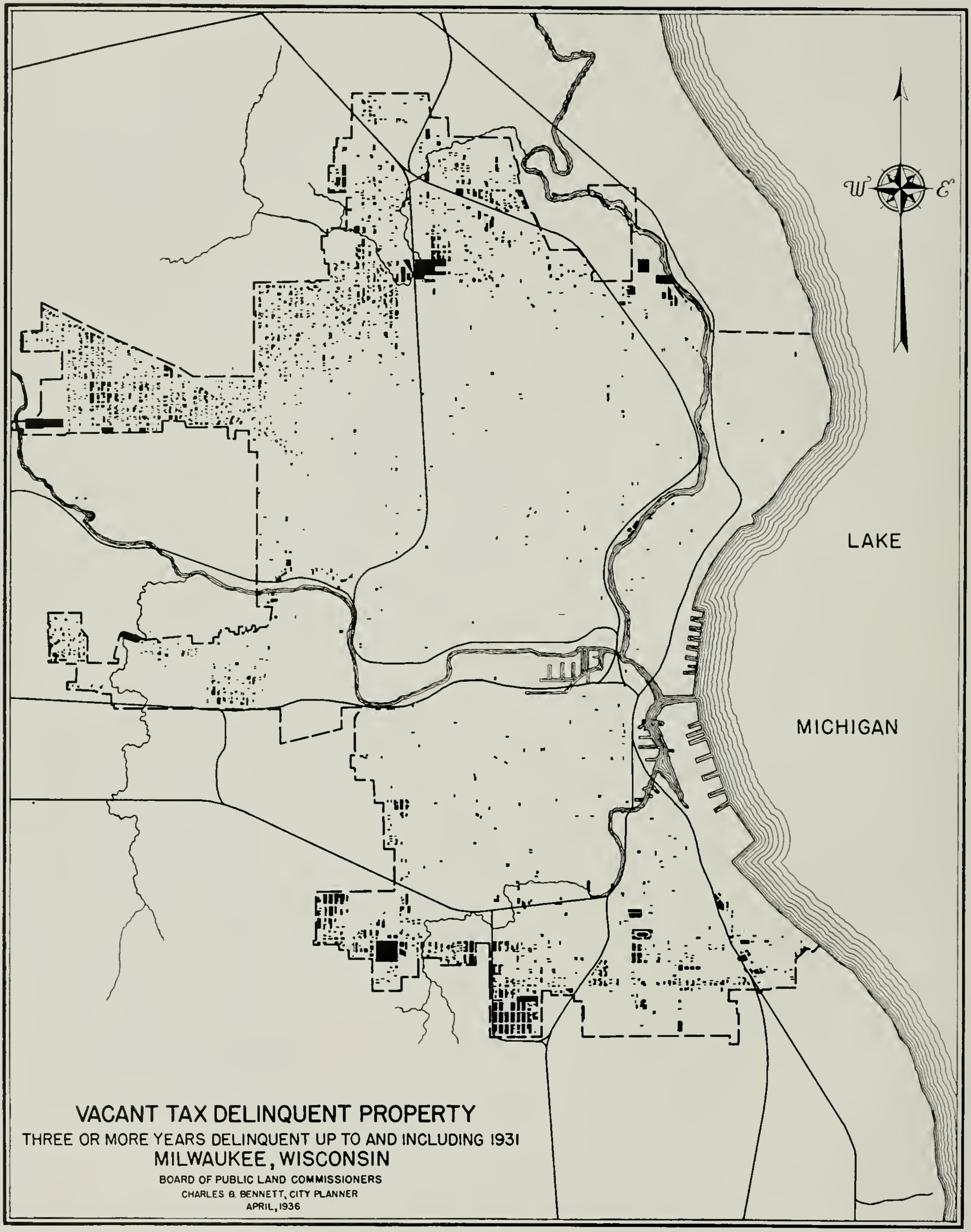

W
E
LAKE
MICHIGAN
VACANT TAX DELINQUENT PROPERTY
THREE OR MORE YEARS DELINQUENT UP TO AND INCLUDING 1931
MILWAUKEE, WISCONSIN
BOARD OF PUBLIC LAND COMMISSIONERS
CHARLES B. BENNETT, CITY PLANNER
APRIL, 1936

FIGURE 9.—Vacant tax delinquent property, 3 or more years delinquent up to and including 1931, Milwaukee.

Thousands of parcels of property are reverting to public ownership in American cities. Many of them are available for low-income housing.

There is much for us to consider in adapting European practices. But the measures suited to the United States must be devised in the light of our particular situation. Some of the steps may be mentioned here.

First of all, State, city, and metropolitan planning boards can very usefully appraise the defunct subdivision problem. A thorough examination of each such subdivision will in itself suggest remedies.

The most painless and genuinely sensible solution in some cases will be to facilitate rather than to retard the reversion of lots which have been abandoned for taxes. In some States it will help to get legislation or administrative arrangements for almost automatic transfer to the appropriate local government of the reverting lands which are needed by that local government. This is a point of great strategic importance in city planning and city rebuilding.

Legislation is needed for compulsory pooling and replatting of lots. Where all of the existing interests, both public and private, in a subdivision will benefit by putting the equities and claims into one pool for replatting and redivision, a small minority interest can still obstruct the reorganization. Thousands of poolings and replattings are needed; very few are effected because there is no machinery available. Compulsory pooling and replatting measures would be extremely valuable in aggravated cases, and they would lead to voluntary pooling and reorganization in many cases, as they have in Germany.

Pending the rectification of the chaos of the defunct and partially developed subdivisions, there still remain unplatted sites in or near most of the big cities and their suburbs and within reach of the essential utilities and services. The degree to which such sites are still available is almost literally a direct function of the public control exercised over subdividing during the great boom of the 1920's. In such metropolitan districts as those of Cincinnati and Milwaukee, the situation is relatively advantageous, while in others, like Chicago and Detroit, the scene is discouraging.

Further, out of the subdivision wreckage, two outstanding possibilities should be mentioned. First, thousands of lots are at the point of reversion or sale for unpaid taxes. As suggested above, those municipalities which are going about to recapture tax-abandoned vacant property are coming into possession of land which is useful for various public purposes and also for housing.[10] Only part of it, perhaps only the smaller part of it, is suitable from all standpoints for house-building purposes, but general municipal acquisition is desirable, for it brings land back into the available category.

Second, after each subdividing and building boom there remain unused lots in among utilized lots. Again, many of these plots are not suitable, but an actual count would bring hundreds or thousands of good ones to light. Between booms, they can be purchased at relatively low figures, often for less than the actual outlay for street improvements. The one-house-at-a-time builder, who, in fact, has provided most American housing, picks up and utilizes such lots. Where suitable, their absorption is advantageous to developer, builder, municipality, and occupant.

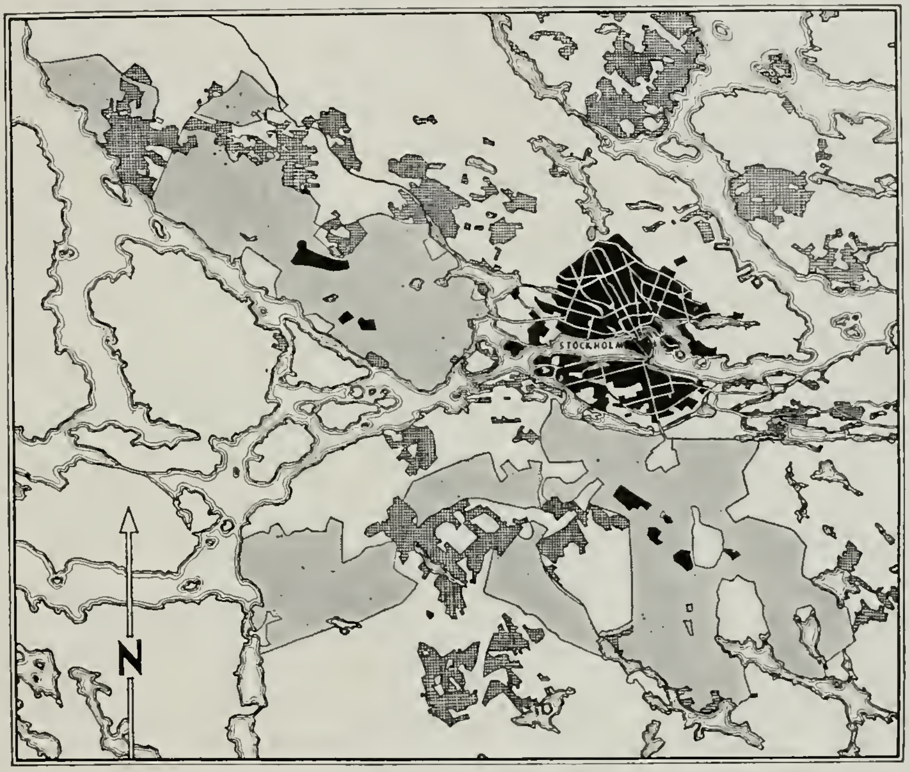


FIGURE 10.—Stockholm, Sweden, and its metropolitan land reserves, 1934. Land reserves in gray; city area in black; suburban developed areas cross-hatched.

While scattered buildings are somewhat more difficult to operate and manage for rental housing projects than a large housing development on a single tract, these difficulties are more easily overcome than many others, so that for large-scale housing, either public or private, the selected tax-reverted lot and the selected post-boom, left-over lot should be considered among the good possibilities for satisfactory location.

Metropolitan land reserves.—During the past century, as the big industrial centers grew up, the governments in many countries have adopted the policy of acquiring and holding what are here designated as metropolitan land reserves. Realizing that for many purposes, including housing, lands should be taken well in advance to obviate both high costs and distorted, uneconomic development, the metropolitan land reserve is a part of normal practice in some urban regions in Germany and Scandinavia, in China and Japan, in several Latin American countries, and more recently in England. In Russia, of course, the Gordian knot of land-for-housing was cut at one stroke when all lands were socialized. We cannot yet adequately appraise the outcome of this step.

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[10] See *Plan Age*, October 1936.

The public land reserve is valuable as an instrument to combat speculation, it is useful for public parks, forests, parkways and highways, watersheds, etc., and in many cases it has been invaluable in making sites available for housing enterprises.

The metropolitan land reserve was introduced on a sizeable scale in this country for the first time in the tracts purchased for the greenbelt suburban resettlement projects. These reserves illustrate the principle; they give us an opportunity to see how it works out in the United States; they constitute one of the eligible locations for housing in their respective metropolitan districts. They are available for use at low cost, and without delay for assembly and purchase.[11]

As suggested in *Our Cities*,[12] an important strengthening of our public policy as it relates to urban problems could be effected through Federal aid to local governments for the advance purchase of needed lands.

Metropolitan regional planning.—Throughout this statement, the need for more adequate metropolitan regional planning has emerged again and again. The time may now be ripe to give it additional impetus. It is suggested as a possibility that the several Federal agencies concerned pool their interest in this matter, and also pool their resources of funds and manpower, to give concerted aid to local governments and private agencies in this vital field. It is considered that the following Federal agencies might collaborate: The National Resources Committee through its central office and its field offices, the Public Works Administration, the United States Housing Authority, the Federal Housing Administration, the Reconstruction Finance Corporation, the Home Loan Bank Board and Home Owners' Loan Corporation, the Works Progress Administration, and perhaps others. Economy and satisfaction in housing programs will be achieved quite largely in proportion to the relative maturity of our metropolitan regional planning work.

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[11] "Metropolitan Land Reserves," *The American City*, New York, July 1937.

[12] *Op. cit.*

II. SITE PLANNING

By Frederick Bigger[1]

The way in which site planning is influenced by the character of ownership and control of the site, by its relation to its immediate regional environment, and by the considerations both of initial cost as well as long-time maintenance and operation is shown. The need for advance planning and the considerations involved in contracting as contrasted with "force account" building of large projects are emphasized.

What is Site Planning?

The term "site planning" means little or nothing to those who have paid no attention to housing developments during the past several decades, or to those who have had no experience with or observation of technical planning procedure. The term has been generally applied to that particular kind of planning which has to do with determining the placement of dwellings and other buildings on the ground, and their relationship to each other, to open spaces for sunlight and fresh air, to open spaces for recreation and amenity, to the roads or streets which give access to the buildings, and to those surface and subsurface utilities which afford the buildings the services of water, sewerage, light, and power, and perhaps fuel.

Because old communities seldom if ever grew according to wise general plans; because they grew by accretion; because the buildings gradually crowded together on the land and eliminated light and air and sunshine; because spaces for play were lost, and became increasingly necessary as the land became more overcrowded and more costly—because of these conditions site planning became an effort to plan all the relationships within a tract of land in such a way as to assure the creation and maintenance of good physical conditions as essential to good community living and good health.

Only where land of considerable extent, under one ownership, was to be had could the site planner accomplish the desirable things he set out to do. In some instances, relatively few in number, this opportunity had been available to the owners of large tracts of land, to the land-and-building developer, to the larger employers who undertook to house their employees. But the modern housing projects of Great Britain and some of the continental countries were chiefly the fields in which modern efficient site planning became increasingly skillful and successful.

Of American cities it is not strictly true to say that there was, until recent years, no site planning of any consequence. There have been two kinds: First, and not ordinarily called site planning, the division of land into blocks and lots with streets to give access to them; and, second, those suburban layouts of special excellence for families of middle and upper middle level incomes, such, for example, as the Roland Park and Guilford developments at Baltimore, the Country Club district of Kansas City, Mo., and many others. Therefore, there has not been an absence of site planning so much as a lack of skill in site planning; a failure to provide for all the factors which should be taken into account in establishing the relationship of buildings to topography, to other buildings, to streets, etc. There has been an inability to cope with economic and legal factors which, although traditionally supposed to be outside the province of the physical planning technician, actually determined whether his planning would be successful with respect to more than one or two isolated buildings and their immediately adjacent open ground spaces.

To those concerned with providing new housing for families of low income, wherein quality, durability, and economy are desirable objectives, site planning may be offered as a means (*a*) of securing convenience of physical arrangement; (*b*) of securing attractiveness and amenity in the physical lay-out; (*c*) of achieving those results with a maximum of economy in relation to the quality produced; (*d*) of encouraging durability and permanence of the physical lay-out; (*e*) of discouraging those mistakes in the site plan lay-out which would destroy quality and social and financial value, and result in blight; (*f*) of assuring long-time social and financial value.

It is important to stress these considerations, lest there be those who are looking for an increasingly astute method of securing the lowest possible *first* cost of land and buildings and their development.

The Need for Thorough and Skillful Site Planning

Discussion of the site planning of well-designed suburban or "country club" districts appears out of place in this document because of the generously open character of such expensive lay-outs, unhampered by the rigid economies that must be considered if the lower income groups are to be housed.

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[1] Frederick Bigger is Chairman of the Pittsburgh City Planning Commission; a director and technical consultant of the unofficial Pittsburgh Regional Planning Association. He was formerly Chief of Planning Staff of the Suburban Resettlement Division of the Farm Security Administration (Resettlement Administration).

On the other hand, it is important to reassert the inadequacies of the traditional urban land subdivision process, and to point out how that process, and the legal and economic points of view that have buttressed it, have been and continue to be major obstacles to the provision of permanently good housing for families of lower income. It is necessary to do this, not because it has not all been said before, but because relatively few persons have been intellectually interested enough, or financially disinterested enough, to study and understand the significance of the analyses that have been produced.

When private industry and private capital undertake large-scale housing projects, comprising lots and single-family houses for sale, there might be reviewed with profit some mistakes of the past. We quote two statements which together should be sufficient to prove the need of that kind of site planning which is described thereafter. The first of these statements is part of a report made in 1928 by a committee of the American City Planning Institute.

CONTROL OF LAND SUBDIVISION AND BUILDING DEVELOPMENT

An outline of prevailing practices which produce great economic and social losses and a statement of principles and preventives which should be applied

SECTION 1. PREFACE

PRESENT CONDITIONS AND PRACTICES

Lack of permanence, of economic stability, and of coordination are characteristic of much of the land and building development of our communities. Because of this, there are great economic and social losses. The prevailing practices which have brought about this result have arisen naturally from individual incentive and habit. Although they have become customary and traditional, they do not represent a concerted effort toward a "community objective" which is acknowledged to be superior to that individual incentive. The significance of these individual practices, viewed collectively, is seen in the following illustrations:

1. In many cases the subdivision and sale of lots is not related to any real demand for building sites, but to an existing or induced desire to speculate in land. * * *

2. There is an almost complete divorce between the subdivision of the land and an intelligent and socially constructive use of the land. Too often the land is not planned with reference to the types of building which are most suitable for erection in particular localities. * * *

3. The "standardized pattern" in land subdivision makes it impracticable to secure permanence in residence neighborhoods. * * *

4. Vast areas are being cut up into streets and lots, with no provisions whatever for small parks for recreation and amenity. * * *

5. Such official control as is at present exercised over the subdivision and zoning of unbuilt land is often inequitable as well as ineffective, owing to a failure to have a "master plan" * * *.

SECTION 2

PRINCIPLES AND MEASURES OF CONTROL

To improve uneconomic, unattractive, unhealthful, and socially wasteful conditions, and to prevent their creation, there must be an effective control of land subdivision and building development. To this end the following principles and measures of control are essential:

1. The major purpose and controlling objective in all regulation of land and building development should be the better conservation of the health, safety, and general well-being of the people. The corollary to this principle is that the entire physical development of a community should be so planned in all its parts, and so constructed, as to assure health, comfort, convenience, and amenity. * * *

2. Effective and economic regulations must rest largely on preventive measures, which should be exercised under the police power and be based on a knowledge of the underlying causes of unhealthy, ugly, and wasteful conditions

3. There should be prepared, officially adopted, actually developed, and enforced, a comprehensive master plan for every community. It should anticipate the community's needs for a considerable period of years. The plan must be accepted as a correlated skeleton or framework, along and within the lines of which physical construction may be progressively undertaken; * * *.

(A) The master plan should include the general lay-out and intercoordination of the various basic systems of public facilities and control; * * * These basic systems should include: (*a*) Water and sewerage systems; (*b*) a major street system; (*c*) systems of transit and transportation; (*d*) distribution systems of the several recognized types of public recreation areas and facilities; (*e*) a comprehensive system of zoning regulation.

(B) In making the master plan, regard should be had to the need for well-balanced growth on the most economic lines, and to the spread or distribution of the population over the entire community and its environs. * * *

(C) The master plan should provide opportunity in the unbuilt areas, and if possible in the built-up areas, to create neighborhood units of varying size and character, which may be so far as possible self-contained as to community needs for schools, churches, shops, and recreation space.

4. Subdivision control should be directed toward a thorough coordination between the master plan, the subdivision lay-out, and the proposed building developments.

(A) The planning board or other authority having subdivision control shall be instructed to encourage, in any appropriate tract to be subdivided, the development of a specific housing scheme not inconsistent with the general standards set up by the zoning ordinance; and, if necessary to achieve this end, to recommend such amendment of the zoning regulations or map as will reconcile the ordinance and the housing scheme to each other, provided there are the fullest safeguards against overintensive use, against the loss of amenities, and against the lowering of the standards set up by the zoning ordinance. * * *

5. The appropriate types of building upon which the design and approval of the subdivision are based should be made more enduring by restrictive covenants running with the land for a period of years.

Comment.—It is socially and economically desirable to perpetuate desirable forms of housing and other uses, and to secure the economies in connection with local improvements; but these results cannot be achieved unless the regulation of building development be at least fairly permanent. * * *

6. In the subdividing of land, small parks and playground areas of a usable capacity, proportioned to the proposed population density, should be provided to the extent reasonably justified. * * *

7. The developers should be required to install, or give bond to assure the installation of, all surface and subsurface street improvements that are reasonably necessary to render the lots suitable for building sites before the land is sold for building. * * *

8. Subdivision control should be exercised, both within a municipality and for a sufficient distance outside, to insure stability of development and a reasonable expansion of utility services.

Summary.—Land subdivision and building development should conform to an intelligently devised and comprehensive master plan. It should be one process, synthetic and coordinated, and no essential stage should be omitted or unduly delayed. The design should be such as to create healthful, economical, and attractive places in which to live. This requires:

a. That streets be adjusted to topographic conditions and be designed in relation to the character, use, and population density of the private properties served thereby; and that, individually and as a system, arterial or main streets be designed as channels wherein traffic may move with facility, safety, and but a minimum of delay.

b. That there be provision or guarantee of utilities, such as sewers, water, lights, sidewalks, and paving, as a part of the initial development.

c. That there be varying standards for utilities according to type of building use.

d. That the relationship be established between the open spaces and the density of population, both as to yard space on individual lots and as to general distribution and usable area of recreation spaces of different kinds.

e. That there be building and housing codes which will be productive of good standards for all types of building.

Submitted by the committee.

Thomas Adams.
Harland Bartholomew.
Robert Whitten.
Henry Wright.
Frederick Bigger, *Chairman.*

Even after improvements in procedure, and wise extension of control, along the lines recommended by the American City Planning Institute's committee, have been achieved, there will be efforts "to beat the game." To build shoddily will be alluring to those who are speculatively minded. Ingenious formulas for beating the financial game are beside the point; certainly they have nothing to do with the problem of site planning as it is approached here. Instead, we quote a document [2] in which housing projects are differentiated from each other with respect to the type of ownership and the objectives of the owners.

It is axiomatic that housing projects in cities necessarily constitute elements of the city plan. They may be alike in that each project is a group of dwellings. But beyond that, there are significant differences which of themselves raise questions of some importance to the planner.

We do not have any very specific and accepted picture in our minds when we use the phrase "housing project." Some classification and definition is necessary. Two major classifications are in order. That which concerns only physical characteristics is a more obvious one, and may be laid aside now. The other classification has to do with ownership, and its social and pecuniary objectives.

Category No. 1.—I would limit this to a housing project which is designed and built as one thing but is destined to be sold off, dwelling by dwelling, to future individual owners. To design this sort of a housing project is to design something as an entity which will not remain an entity afterward. By this I mean that the individually owned small properties, into which the project will have been converted, are hardly likely collectively to retain intact the wholesome characteristics of the original unified design. Each of the individual owners will be subject to the vicissitudes and hazards of small property ownership, to which in the past our communities have been altogether too oblivious, Changes in the family financial status, or sale of property to another family with a different point of view or different mode of living—these and other unpredictable conditions will tend to break down the original lay-out and character of the planned project. Therefore, from the point of view of the general public and from the point of view of the public officials, the kind of project here discussed may be nice to think of in the beginning, but is not an unqualified blessing for the urban community if the hazards of the future are considered. It cannot be emphasized too strongly that these hazards are real and serious. * * *

Category No. 2.—Here may be included a housing project designed as an entity, but destined to be rented to many individual families, at the generally prevailing rates. This is a commercial venture, in which one or the other of two alternatives must be noted: (*a*) either continuity of ownership is implied, with the housing project representing a long-term high-class *investment;* or (*b*) the ownership may shift from time to time, possibly quite frequently, with either gain or loss to the seller, in which case the method of handling the project makes it a venture of *speculation.*

In the case of the housing project which is an investment, the problem of the designer is to make a design for living, the conveniences and amenities for the occupants of the dwellings being a major consideration in order to prevent vacancies and to preserve tenant satisfaction and stability of income. In the case of the venture which is speculative, although the designer may have had comfort and amenity as one of his objectives, the actual manipulations of ownership have converted the project into something in which the housing is a mere commercial commodity, and the comfort and well-being of the occupants of the dwellings will in varying degree have less consideration than the primary pecuniary one.

Category No. 3.—In this group may be included all housing projects which might be carried out by a limited-dividend housing corporation or by a housing authority, wherein rentable dwellings are produced, calculated to serve people of modest or low income, and under a policy of limitation of rent and return on the invested capital. In this case there is a social objective, the promise of which is implied by the very undertaking itself; and the designer will provide all the comforts and conveniences that he can reasonably furnish with the money which is to be expended, and with a careful calculation of the probable rental that can be secured from modest-income and low-income families. The difference between this limited return on the invested capital and the return upon ordinary commercially invested capital represents the premium that is paid to achieve the social objective. This type of housing project, in theory at least, and, of course, if well designed, is a permanent asset as a part of the city pattern. However, it might very well be that such a project would be but one attractive oasis set down in the midst of other housing which is completely subject to commercial manipulation. In that event there would undoubtedly be a constant tendency for the desirable housing project to break down and become less desirable because of the conditions existing in the surrounding neighborhoods. This immediately suggests to the planner that, if at all possible, the future safety of a good project of this kind conceivably might be safeguarded if the project itself were completely surrounded by park areas which would effectively separate the project from the less desirable surrounding neighborhoods.

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[2] Read before the joint conference on planning of the American City Planning Institute, American Planning and Civic Association, and the American Society of Planning Officials, in May 1936, at Richmond, Va.

Category No. 4.—In this group we must include all projects which are similar to that described under category No. 3, but different only in that the ownership is different, i. e., the ownership here being vested in the occupants of the houses—each renter being also a part owner of the entire project. This is the same idea that we know as the traditional English copartnership housing, and it is not essentially different in its principle of ownership from that applied in the familiar cooperative apartment buildings. I reaffirm the warning to provide protection against the malign influences of blighted districts and undesirable housing which surround a well-designed housing project.

These four classifications, when reviewed, drive home to us the importance, to the planner, of knowing (*a*) whether a housing project is to be split up for ultimate sale to individuals; (*b*) whether it is to be utilized as a manipulated profit-and-loss commodity only, regardless of a paramount interest of the occupants of the dwellings; (*c*) whether there is a social objective contemplated, and in a measure secured by an effective limitation of income and of rent levels; and (*d*) whether or not the occupants of the dwellings are themselves the owners of the group of dwellings. The importance I assign personally to this matter may not have your concurrence; but I maintain that the issue is a vital one, even if we look at the entire matter without any bias favoring housing projects based on social objectives as contrasted with housing projects based on pecuniary objectives.

The joker about ownership.—If there were such a thing as a "realist," I think he would say something like this about ownership. He would admit that the possession of a title deed, and the complete freedom of the property from any lien or mortgage, could be called real ownership, since it involves complete control or opportunity to control on the part of the owner. On the other hand, if one holds a title deed to property, but continues to be obligated to pay considerable sums to some money-lending institution on a mortgage or a note of any kind related to the property in question, then certainly ownership is only partially vested in the so-called owner who holds the title deed. He is not free to control; he may not be able to meet the financial obligations upon his dwellings; he may very well have to give it up and turn the property over to someone else who can pay to the money-lending institution the monies that are due. In hundreds of thousands of instances of presumed ownership the ultimately effective and therefore the "real" owner is the holder of the mortgage. As I am not settling the affairs of the world, I pass on after posing the question: When is an owner not an owner?

Relationship of owner's objective to the problem.—Obviously, those who hold an equity in property, those who hold a financial interest in it, are owners. If these owners are not identical with the occupant families in the project, then we have divergent forces. The needs of the occupants for more space and better living pull in one direction, while the demand for return on investment, or profit from speculation, pulls in the opposite direction. * * *

Why so relatively great a proportion of my presentation is devoted to this issue will be somewhat clearer if I give an example. The planner necessarily is controlled by the over-all financial consideration arising out of the cost of his land, the cost of revamping or building new public utilities, the cost of dwellings, the cost of attractive landscaping, etc., in addition to the basic item of cost of financing of the project. If he thinks carefully, he knows that he may have to provide funds for, and to design and construct, for example, sewers or a public school, because the city itself has not yet provided them to serve the part of the town in which he is proposing to locate his project. The designer realizes that the city with which he is dealing has not completely developed its entire utility system and school system for the service of a comprehensively designed distribution of dwellings, commercial buildings, and industrial areas. If a purely pecuniary objective controls the designer, he will locate his housing project so that it can be subsidized by the existing community through an earlier provision of utilities and schools, even though some other location involving new construction of some of these facilities is a better one from the standpoint of the community's social and financial interest, i. e., better from the standpoint of the city plan.

Projects as assets and as liabilities.—We have seen that of the four categories of housing project listed in the beginning, No. 1 (that which becomes a multitude of separate ownerships later) and No. 2–b (commodity housing on a speculative basis) might very well be said to promise no permanence and no stable contribution to the community. Those types might be thought of as leeches whose nourishment is filched from the social and economic lifeblood of the more stable parts of the community. That would be a fair assumption, in the case of one because individual owners have no ability to cope with the disintegrating forces which surround them; and the other speculative one because its basic intention is to get the most out of the community with the least possible contribution by itself. On the other hand, long-term investment housing, copartnership housing, and limited-dividend and rental housing all share the need for certain stability and continuity of existence within the urban pattern. So we have every right to expect the community planner (city planner or town planner or regional planner) to look askance upon the two kinds of housing and with favor upon the others. That he must have an opinion is axiomatic, if he is to assist in the determination of the relationships of dwellings to open spaces, and of both to streets and other buildings—which relationships he must deal with as a planner.

Technique of Site Planning

A field as complex as that of site planning, in which there are so many variables and imponderables, cannot be reduced to a formula. How some of the most important factors are dealt with, and the extent to which their interrelationship is properly adjusted, largely will determine the success or failure of the site planning. These significant factors are:

1. The characteristics of ownership and control of the contemplated housing project.
2. The relationship of the site to its immediate and regional environment.
3. Initial cost of development versus the cost of maintenance and operation.
4. Time allowable for planning: when construction is to start.
5. Construction by a private contractor versus "force account" construction by a public agency.

1. *The characteristics of ownership and control* of a contemplated housing project, have already been discussed at considerable length and the significance of that point should be clear. It is really axiomatic that the site planning of property which is to be subdivided and parceled off to different owners later is a different problem from that of the site planning of a single tract which is to remain intact and be occupied by rented

housing. This difference in planning, ignored by the inexperienced and unknown to the layman, was mentioned by the late Henry Wright in a warning to the plan copyists. He stated that the best site plan for a one-ownership rented-housing type of development need not include some of those provisions which would be essential in the other type of development, where it is necessary to make it easy to divide the land into parcels for sale. He qualified this by saying that a project completely developed with everything, including buildings, is, of course, not in much danger of being drastically mutilated by what individual lot owners may do to it, at least not until the time arrives when there is need of, or advocacy of, the erection of new buildings or extension of old buildings on the originally unoccupied land which had been set aside as yard spaces for the dwellings. In the project intended to be parceled off to different lot owners, the compulsion to keep each lot free of all utility lines that serve other lots, and the effort to make all lots as saleable as possible, almost always restrict the ability of the designers of the utility systems to secure the maximum economies consistent with efficiency. In the case of the consolidated tract which is to remain intact and occupied by rented dwellings, the designers can run their utility lines across any part of the property, securing the shortest runs of trenches, water pipes, conduits, pole lines, sewer mains, etc., and there will result both economy and efficiency. Moreover, the stability of the project which remains under centralized ownership and control means permanence of financial value. It will mean assurance against breakdown of both character and value. It will be assured against the usual influences creating blight. Examples of this type of site planning are Sunnyside, Long Island, N. Y.; Chatham Village in Pittsburgh; the new town of the Farm Security Administration at Greenbelt, Md.

Even with the more acceptable type of property ownership and control, however, it is not always possible to assure the theoretically greatest economies in lay-out of underground and overhead utilities and services. Admitting that the topography itself is often the most significant factor, if there should be a need for a certain kind of street pattern, or for particular types of building and their placement and orientation, these requirements may modify the lay-out of utility systems sufficiently to lose some of the economies—economies which otherwise are derived out of the freedom to go anywhere throughout the one-ownership tract.

2. *The relationship of the site to its immediate and regional environment is significant*—

a. With respect to soil and drainage conditions; to climatic conditions; to prevailing winds and to sunlight.

b. With respect to the existence of, and accessibility to, water supply and distribution lines, trunk sewerage and sewage disposal facilities, fuel gas services, electric service, transportation of various kinds, recreation facilities, schools, adjacent or surrounding urban or rural land and development.

c. With respect to laws and ordinances (including building codes, highway construction regulations, zoning regulations, the control of official planning agencies, etc.).

It goes without saying that the theoretically cheapest development of a site from the standpoint of first cost could not be applied where there are great irregularities of ground contour; or where good subsoil bearings for foundations do not exist, or exist over but part of the area. Obviously, it is the job of the site planner to determine whether required grading and utility system installation will so increase the cost of the "ground prepared for building" as to warrant the abandonment of the site and the acquisition of another where, with a higher purchase price plus less expenditure to prepare the land for building, the aggregate cost is less. This fact, frequently disregarded by municipalities with resulting extravagance, points to the need of making preliminary examinations, studies, and estimates wherever possible prior to the acquisition of the land. Criticism of excessive site-development cost cannot be entirely valid if the site planner has had neither time nor opportunity to do this preliminary work and to accept or reject proposed sites on the basis of his findings. With respect to public housing projects particularly, an entirely unnecessary and deplorable extravagance will occur in many cases because sites are acquired, through political strategies or with undue stressing of the need for speed, without first having been technically and financially verified by preliminary study and planning and cost estimating.

As to prevailing winds and orientation, due consideration of these factors, not measurable directly in dollars, may very well indicate an arrangement of blocks and of buildings which will make the site development cost somewhat greater than if these factors are disregarded. There is no substitute here for practical common-sense judgment. In hot climates, to fail to take advantage of prevailing breezes would be stupid. The great crescent-shaped plateau on which Greenbelt is being built is swept by the prevailing breezes blowing through the low flat valley lying windward of the crescent. Again, if dwellings are themselves properly designed and do not exceed two rooms in depth, there is not so much need to place them in the most mathematically perfect relationship to receive maximum sunlight the year round in all or in specific rooms. I believe that, following certain interesting experiments in Germany, there has been shown in this country at times an inclination to overstress orientation of buildings and the various rooms within them. Always, I would urge a common-sense decision, for there is no doubt that in the effort to secure theoretically perfect orientation there are added certain other costs and complications that could otherwise be avoided.

The factors of regional utility services and transportation must be approached with the same willingness to appraise alternatives. If no public supply of water is available, will the tapping of an original and independent source for the service of the site add a prohibitive extra cost to the project? Would selection of an alternative site make that extra cost unnecessary? If a public supply exists, how should the services be connected, at what cost for installation of trunk lines, and what price, if any, must be paid for the water? There is a similar analysis to be made with respect to sewerage and sewage disposal. Must the planner provide for a sewage-disposal plant on the site, and if so where will it be located to best advantage for economy of operation, for economy and absence of nuisance elements if an incineration plant is established in connection with it? Will separate systems for drainage and sewage be essential? Is the locality serviced now by a dual or a combined system, and must the proposed site's utility layout conform thereto? Gas and electric systems of public service companies are generally extendable at company expense when there is assurance of an adequate number of consumers or an adequate amount of consumption. Here, however, the alternatives that must be appraised, because there is no one generally applicable solution, include those of (*a*) locating and constructing an independent electric generating plant on the site; (*b*) agreeing with the utility company upon the location and type of extension into the site if done by the company; (*c*) agreeing upon the feasibility and cost and desirability of surface, subsurface, or part surface and part subsurface installation of the distribution system throughout the site; (*d*) determining location and character of transformer installations and the like; (*e*) comparing consumption rates if current is used for heating and cooking as well as for lighting as against the latter only, and the questions of metering that are involved in these decisions; (*f*) comparison of available gas service when and if installed, as against electricity or oil or other fuels, and the problem of possible consolidation of distribution lines in trenches with other utilities. There is not, and cannot be, any other procedure for the site planner but to analyze and appraise these and other alternatives thoroughly, with estimates of installation and maintenance and operation costs, if full advantage of competent planning technique is to be had. It is the absence of such comprehensive utility planning that represents one of the less-known but obviously great extravagances of ordinary municipal development and expansion. Although it is impossible to give fully adequate examples of the proper treatment of these subjects by planners, the technique itself and its possibilities are exemplified in the case of the three major Greenbelt town projects of the Suburban Resettlement Division of the Resettlement Administration.[3] In those cases there was a compulsion to begin construction simultaneously with the beginning of the planning study, and on a site already acquired and not previously studied in the preliminary manner suggested earlier herein. There was no alternative but to proceed, to make the best out of what was there, to waste no time checking up and properly verifying the desirable correlations of utility planning among the various services and in relation to the placement of buildings. Nevertheless, because the planners were experienced professional and technical men, their work was remarkably well correlated. Their reports and recommendations along these lines, as submitted to and approved by the Director of the Suburban Division, are the first (perhaps the only) and most comprehensive records of this technique that can be cited. They are too voluminous to quote in full, but two or three are submitted in the appendix of this document to illustrate the application of the technique. In the appendix also are listed the subjects covered by these "summary reports and recommendations" insofar as they concern site planning specifically.

Transportation is admittedly a matter of significance in the problem of developing housing. It sometimes requires no special study where the site is an urban one already accessible by transportation service. In the case of suburban or rural sites reachable by extension of existing transportation lines or the establishment of new lines, special study will be needed with respect to the routing of the lines into or through the site being studied. This may very well point the way to special differentiation of the proposed streets of the community, variations in grading and paving, etc. It may be an important factor in influencing the pattern of blocks and streets. And these, in turn, will affect the utility distribution systems. Obviously, the cost of transportation service to the families in a housing project is a part of the family budget and has its effect upon their ability to pay for shelter, food, and clothing.

Developed or even undeveloped recreation areas are so rarely provided in suburban and rural areas that the site planning for housing will perforce involve provision not only of the playgrounds and open spaces that are set up in any good site plan between and among the buildings, but also the designation of adequate park and athletic areas. In the case of urban sites, there is more likelihood that there are recreation areas in existence, but it is fair to state that only rarely are there urban parks, playgrounds, and athletic fields adequate in size, sufficient in number, or properly placed to serve the people for whom they are ostensibly intended Therefore, although the planner may sometimes legitimately allow for the known accessibility of a developed municipal recreation area outside the boundaries of his site, he will be compelled to assure adequate areas either on his site or outside it, or both. Here another vital question arises, answerable now only on a common-sense basis. The question is: In the effort to develop housing for those of low income, is an element such as a playground a needed standard or a luxury? Admitting the great lack of and great need for recreation spaces properly developed, to what extent can the developer make reservations on his site which will be kept clear of buildings and will be developed for the recreation of the occupants of the housing project? Upon whom will fall the cost of the recreation areas and their development?

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[3] Now the Farm Security Administration of the Department of Agriculture.

Again, the site planner will allow for any school facilities that exist beyond his site, but in the interest of the future population of the site, he must be aware of the present and future needs for school facilities and his site plan must provide for their proper location within the site when that has been judged necessary. Who will pay for that school building plot? Will the cost of the educational facilities per family be prohibitive in terms of the family budget?

It is more difficult to point out in what manner there can be an effect upon site planning of building regulations, zoning ordinances, the regulations of State or local sanitary officials, the regulations and control of highway officials or of official planning agencies. The requirements for foundations, for sewerage and sewage disposal, for water supply, for road widths and design and types of paving, for sidewalks, for methods of procedure in construction, all these when applicable ordinarily would not seem to involve anything that the competent and thorough planner would not himself provide. However, the regulations are, on occasion, unduly stringent and sometimes administered inflexibly by officials with little imagination. Here, it is apparent that there can be much variation between what regulations must be coped with in urban as against suburban or rural localities. Those concerned with minimum legitimate costs of housing will recognize (*a*) the greater freedom of choice outside of urban areas, normally, although this will be weighed against probable greater costs of some other phases of site development; and (*b*) that again these questions are matters for common-sense analysis and judgment. Without undue or sweeping criticism, it might be ventured that official planning bodies, when they do exercise control, have at times exercised a too meticulous supervision of details of large-scale housing projects and required modifications of the site plan that could not be entirely justified. Certainly in the interest of good housing, new projects require proper planning, proper public services, proper recreation areas and other open spaces, even though those projects are intended to be occupied by people of modest or low income, and even though the ultimately developed and occupied site may not make sufficiently large tax contributions to maintain and operate those facilities. A cynic might well ask whether such admittedly desirable facilities can and should be developed fully and first in the low-income housing project sites, before supplying such facilities to the mass of people in congested urban areas. Again, and for the present, only a practical common-sense attitude is reasonable, because it is impossible now to devise and secure agreement upon a broad and theoretically perfect community policy that can be made to work.

3. There must be established in some fashion, as a matter of policy (arbitrarily, perhaps, at this time), the most reasonable relationship between the initial cost of a housing project (including, of course, its site development) and the estimated probable expenditures that will be required for maintenance and operation over a period of years during which the buildings will remain habitable and during which their first cost is being amortized. Any housing site must be as consistently developed in relation to these calculations as are the buildings. It is obvious that man can build cheaply, but it is not proven that what he builds most cheaply can be of a standard acceptable as a national housing norm. If cheap building of dwellings is undertaken, should utilities, for example, be more permanently conceived than are the buildings? Coming directly to the point, the cheapest and easiest thing to build (i. e., what some people advocate for what they meaninglessly call "low-cost housing") is certain to become increasingly costly to preserve and maintain over a period of years. This is true of buildings and of the public utility installations which are part of the site plan development. There is a point somewhere, not heretofore calculated, where there is a reasonable and common-sense balance of initial expenditure versus maintenance and operation expenditure. To discover that point is of no concern to the speculator or to the developer who builds to sell, both of whom leave a succession of sucker-purchasers to take the losses through the ensuing years. It is of vital concern to those who strive to solve the problems of providing living conditions of a proper standard which have some chance of remaining so. This is a basic issue in housing, broad, complex, and ramified in its implications, and not to be exhaustively treated here. However, there are related financial factors in the so-called value of the developed property during the ensuing years. When a

site is not intended to be sold off in pieces of "commodity housing" to endure the vicissitudes of a speculative real estate market, there is a difference in such factors as its sale value as a whole, its value as a part of the assessable wealth of the community, its value as a locality not requiring an excess of public or philanthropic expenditures because of substandard conditions. All these things imply that the present credit system ought not to accept lowest first cost as a determining factor in housing generally or in site planning and development specifically.

Whenever in the past this element of permanence of value has been disregarded, whenever entrepreneurs have essayed the task of reducing the cost of housing, the things that were sacrificed first were space, quality and durability of materials and workmanship. It is no innovation to have these latter expediencies suggested now; but efforts to reduce the cost of housing need first of all to be orientated with the problem itself, and the problem needs first to be stated. That part of this problem which falls into the category of site planning, this document attempts to clarify. As I have said or implied before, there is no formula; there are no cute graphs that show the advent of the millennium; there is no substitute for thought and sound judgment exercised by skilled persons in particular cases, on particular problems, with all the factors appraised individually and collectively.

4. *The time allowable for planning* cannot be determined by any generalization. Although the Suburban Resettlement Division of the Resettlement Administration, with an amazing degree of success, started the specific planning for its major projects almost simultaneously with the putting of large construction forces to work in the field, the procedure cannot be recommended. No satisfactory results can be definitely assured unless ample preliminary time is allowed for planning. Preferably, this should include the opportunity to make the previously suggested preliminary site plan studies and estimates *before the land is purchased.*

5. *Construction by private contractors versus "force account" construction by a public agency.*—Decision between these alternatives will affect site planning. In theory, the contract system implies some difficulty in making changes and adjusting claims therefor. In theory also, the force account method seems to imply more flexibility, greater freedom to adjust modifications in the field. Actually, a force account construction organization is tied to its related procurement agency which secures building materials; and freedom to make changes is limited by the status of ordered and delivered materials. Beyond that point, if the construction division thinks it knows better than the planners what and how to design and build, innumerable difficulties, delays, and sabotages will occur, unless, of course, there is a broad-visioned, astute, and competent administrator with authority to prevent these difficulties. The real points are (*a*) that economy in both planning and construction are reconcilable and not in any essential conflict if undertaken sequentially by competently manned agencies so related as to eliminate rivalry and sabotage; but (*b*) that under other circumstances the site planner will be compelled to design and redesign his site lay-out and his utilities systems to the point of entailing extra costs rather than securing the economies possible by proper and comprehensive site planning.

Special note on heating.—The factors discussed here are, of course, not all the considerations that are involved in site planning. The type of building construction, the architectural characteristics that are usually referred to as "style," the landscape treatment most suited to a particular region or best suited to land which is wooded or is traversed by streams—all these will be taken into account by the skillful site planner.

However, the problem of heating buildings is a factor of very considerable significance to the site planner. The installation of heating facilities is a factor of initial capital investment, and the operation of the heating facilities affects the economy of the individual family and the project management throughout a long period of years. Along with heat we must consider domestic hot water; and there should be analyses of the different fuels and the different modes of house heating, before giving final judgment.

In any case, the cost of construction of buildings is involved because of need or absence of need for chimneys, cellars, driveways for delivery of fuel and removal of ashes, etc. The planning and placement of buildings are both directly related to this problem, and the site planner must examine the problem with the architects and their mechanical and heating engineers, and with them reach a joint decision and adjust the site plan accordingly. By way of illustrating this point at some length, some (but not all) of the findings and recommendations of the project planners of the town of Greenbelt, Md., are attached. (See Appendix.)

From experience and observation, and from consideration of such factors as have been discussed herein, it is reasonable to conclude:

a. That centralized ownership and control of a site and housing development, together with a policy of dwelling occupancy by tenants or by copartnership owner-tenants, will allow the site planning to be most efficiently and economically completed, will assure maximum construction economies, and will assure longer duration of higher social and pecuniary value to the project.

b. That there are factors of relationship of site to immediate and regional environment that should encourage (1) preliminary tentative site planning and estimating prior to acquisition of land; (2) thorough and analytical appraisal of alternative solutions of the technical plan problems that are involved, with respect to efficiency, relative economy of first cost, and economy of maintenance and operation; (3) that there are no formulas for solutions of these problems capable of general application, and no substitute for thorough analytical study and skillful planning.

c. That the lowest first cost is not a desirable objective; that economy of maintenance and operation costs is highly important during ensuing decades; that there should be common-sense judgment applied to establishing a proper balance between initial first cost and the cost of maintenance and operation.

d. That all planning should be thoroughly done prior to the initiation of construction.

e. That construction by private contractors is preferable to public construction organizations operating on "force account"; that, if the latter is inescapable, the technical planning forces and the construction forces should be under the same broad-visioned, astute, and competent administrator.

Incomparability of Site Planning Values

No one has calculated, certainly not in any extensive way, what the absence of skilled site planning as we now know it has cost those communities which failed to apply it. No one has calculated, or could calculate, the smaller cost of any project which has been skillfully planned throughout, including the site planning, as against the cost of such a project if undertaken with little or no planning. By the same token, no one can calculate now what further economies can be achieved by skillful site planning alone. One reason is that we have in this country, as yet, but a very few skillfully planned housing projects; another is that existing well-planned projects have never been, and probably could not have been, made comparable with each other for the purpose of appraising relative economies. A final reason is that the socially beneficial characteristics of the physical lay-out are incalculable. Since these socially beneficial characteristics are what the site planner is trying to assure, and since they cannot be precisely compared or precisely measured in dollars, it is clear that both the planner and those who are merely dollar-minded will agree that good site planning is not a method of achieving lowest *first* cost in dollars.

Examples of Site Planning

The materials quoted in this section furnish examples of the kind of thinking that the site planner uses—the analyses upon which he bases his conclusions. These thinking processes are as much a part of site planning as are the maps and plans which show graphically the physical arrangements which are proposed. It is impossible now to enumerate all the technical analyses and plans which might be assembled to illustrate the planning process; and it is very doubtful, if they could be assembled, whether their relative validity or importance could be appraised in any useful way. One special study may be mentioned. Clarence S. Stein's "Studies of the relative improvement costs of various schemes of house grouping" were made in November 1935 for the Suburban Resettlement Division of the then-named Resettlement Administration. The purpose of the studies was "to measure the comparative efficiency of various methods of grouping houses as affecting street, yard, and park improvement costs." Inasmuch as that document, with its illustrative diagram plans, has never been published, only part of the general findings are submitted here. It must be remembered that any such analysis depends for its validity upon the arbitrary first selection of comparable standards upon which the calculations and comparisons are based. Mr. Stein stated:

> 1. The cost of improvements per house is greatest when houses are built facing on main roads. (Houses on main traffic ways are also probably the least desirable for good living.) Schemes 10 and 11 [not reproduced here] show similar arrangement of houses, the one on a lane and the other on a main road. The estimates of these two indicate that conditions of soil and contour being equal, the latter will cost about 38 percent more than the former.
>
> 2. Improvement costs of houses on lanes are increasingly cheaper per house as the length of lane increases. It is apparent that a superblock of 1,000 feet in width offers economic advantages over a block of half this width unless there are site conditions that overbalance the saving from decreased length of main highway and main lines of utilities per house.
>
> 3. The cheapest arrangement, as affecting improvement costs, is that of row houses on lanes without vehicular roads in the lanes, but with garages grouped at entrance to lanes. This arrangement has great advantages from the point of view of good living. It offers increased safety and quiet on the service side of the houses and at the same time it permits complete privacy on the garden side. On the other hand, some planners may prefer to sacrifice these advantages for the convenience of direct access to each house by automobile and greater ease in the delivery of bulky goods and fuel, and easier fire protection.
>
> 4. The lanes without roads show a cost advantage of about 18 percent over those with roads. However, the length of lanes without vehicular roads must be limited to facilitate delivery of heavy and bulky goods and of fuel. The proportionate difference of cost is greatly decreased when lanes with roads are increased to the greater length that their arrangement makes practical and acceptable. But, the economic advantage of the lane without roads will be increased on hilly sites where road construction is difficult and expensive.

In a second part of Mr. Stein's study, after calculating different elements of cost, exclusive of the cost of land, a table is shown in which five schemes are compared. The total cost per family, i. e., cost per dwelling unit, for these five schemes is $4,023.24, $4,194.56, $4,277.71, $4,484.32, and $4,721.00. Similar variations in cost estimate, based on different arrangements of buildings in relation to the streets and public utilities, have been produced in other studies. This is cited as an example of the fact that studies of site planning reveal less expensive ways of securing the same general result. It is an example of thoroughness and skill in site planning, rather than a proof that all site planning is skillfully done or that site planning produces economies if badly done.

Thomas Adams, in volume VI of the *Harvard City Planning Studies*, "Design of Residential Areas,"[4] presents comparable plan arrangements, and analyzes them so as to show the economies achievable without loss of quality. It is evident, for example, that the sole criterion is not the number of lots in the plan—that the cost of the lot developed with its street access and utilities is even more important. Certainly this is true on any long term basis, even if it is not true in a speculator's heaven where quantity and rapid turnover are the ministering angels and quality is ignored. We omit plan A, which shows the original three gridiron blocks, and reproduce the four studies as figure 11. About these Mr. Adams says, in part:

* * * I have made four replatting studies for an area composed of three blocks, each 588 by 200 feet and surrounded by 50-foot major streets and 40-foot secondary streets. (See figs. 21, B–E.) These are the dimensions used by Morris Knowles for the typical block of single houses in the assumed town plan on which he based his study, "The Relation of Size of Lots to Cost of Utilities and Street Improvements in Low Priced Housing Developments," prepared for the President's Conference on Home Building and Home Ownership.[5] It will be observed that the raw land cost is 2.5 cents per square foot. The local improvement costs are summarized on each diagram * * *.

Plan A shows the arrangement of this area on the gridiron system, with 84 lots, measuring 42 by 100 feet and costing $716.36 each for land, streets, and sewers. The center lines of the streets surrounding the area are taken as the boundary for replatting. In every proposal except plan D the cross streets have been eliminated and the three blocks have been thrown into one.

Plan B shows the conversion of the interior of this new enlarged block into a small park of 4.49 acres, and provides 50 lots, each 42 by 100 feet and costing $680.96. The apportionment of the cost of the open space to the lots would increase the cost per lot to $778.82.

Plan C is similar to B except that it provides 56 lots at a cost of $608.18 each, which would be increased to $695.38 with pro rata addition of the cost of the park.

Plan D attempts a less expensive arrangement, with more lots and a smaller park area, probably too small for efficient supervision. It shows 74 lots costing $586.64 or, with park cost added, $623.41.

Plan E is platted for semidetached houses and presents a more economical and otherwise better arrangement than the preceding

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[4] 1934.

[5] Vol. 1, *Report of Committee on Utilities for Houses*, pp. 147-162.

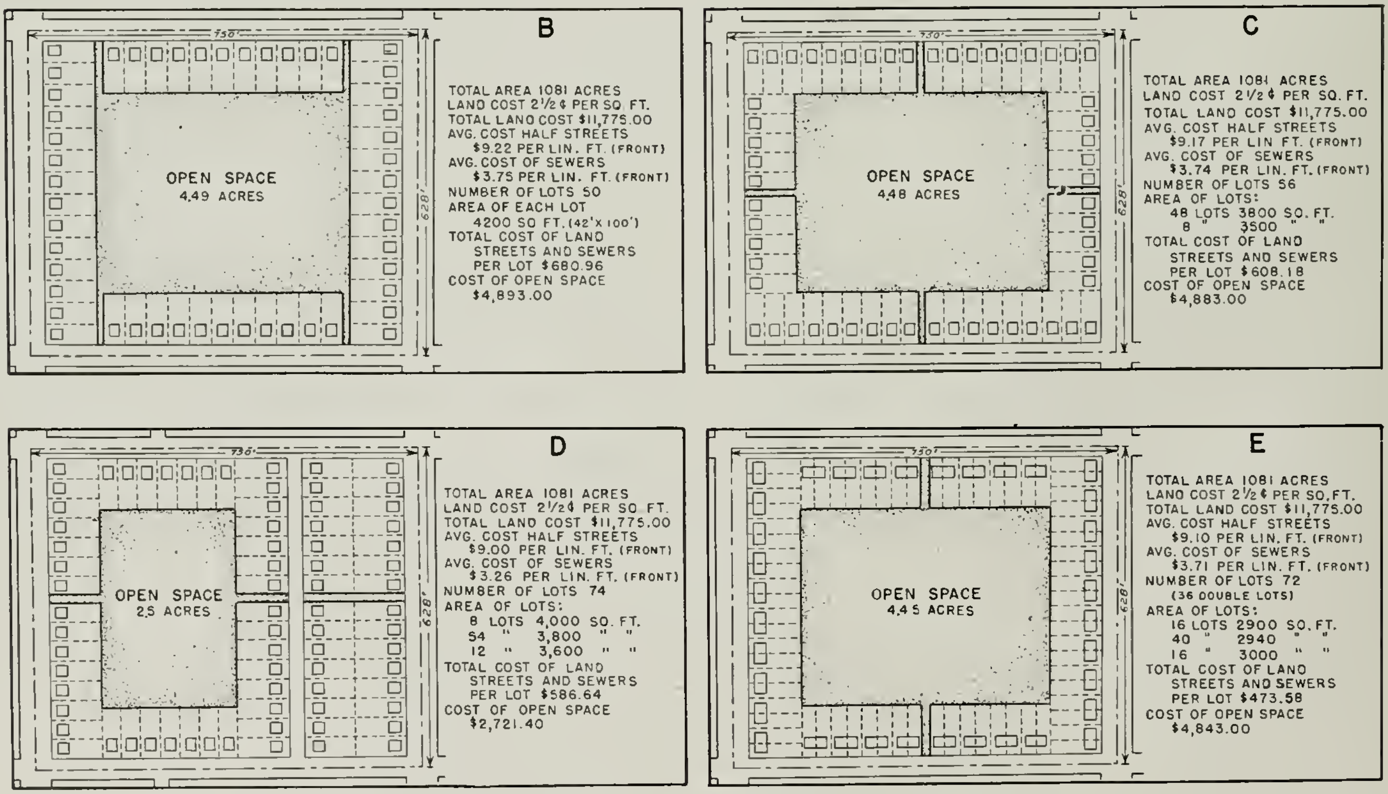

FIGURE 11.—Four ways of replatting a given city area.

These four studies are from the *Harvard City Planning Studies*, Vol. VI, "Design of Residential Areas," by Thomas Adams.

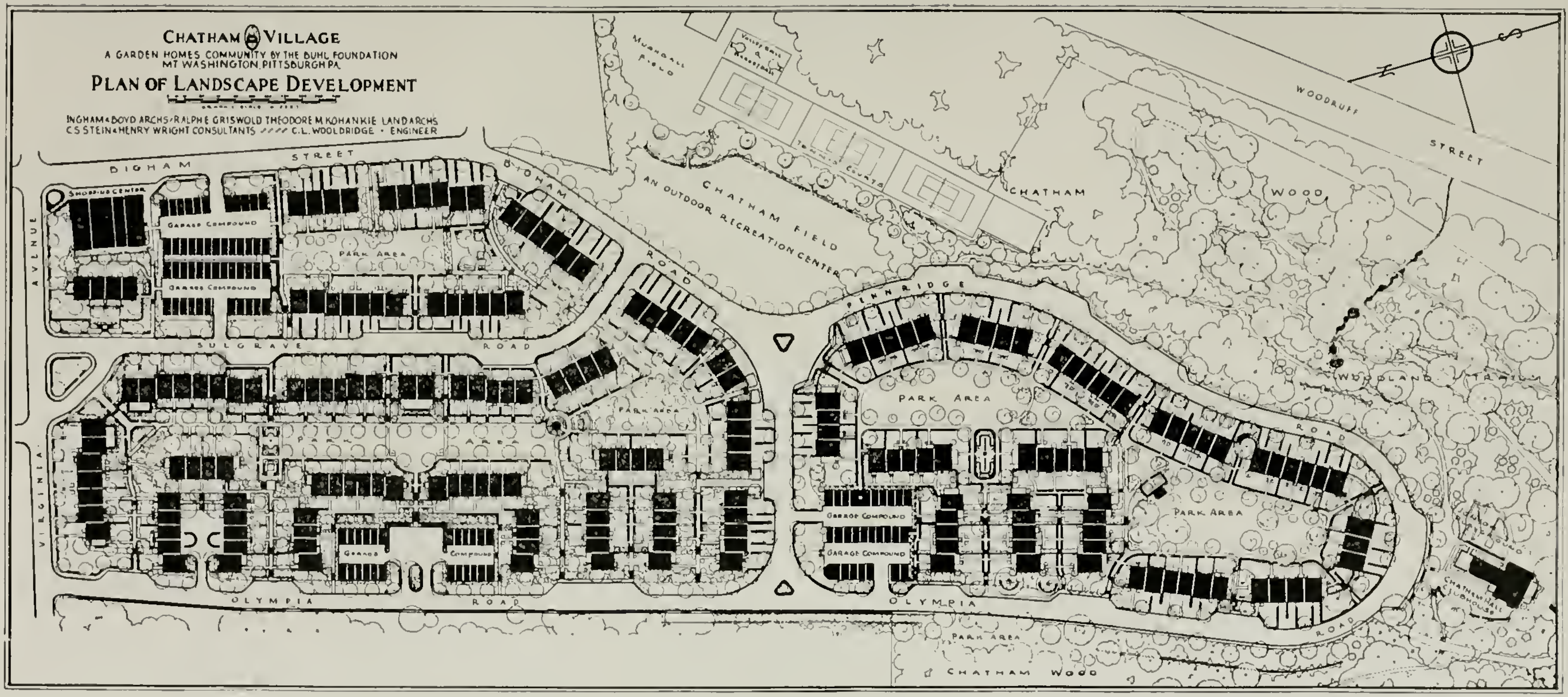

FIGURE 12.—Chatham Village, Pittsburgh: Final plan.

This plan is reprinted by permission of the Buhl Foundation, whose report for the period ended June 30, 1937, describes the village as follows:

In the past 5 years the Buhl Foundation has invested approximately $1,650,000 in Chatham Village, a project conceived and built to demonstrate the social advantages and economic soundness of carefully planned large-scale residential communities, built from the ground up in one operation and managed on a long-term investment basis.

The first unit of 129 homes and auxiliary commercial facilities, opened in May of 1932, has since been augmented by the construction of a second unit of 68 homes. Sixteen acres of land have been taken for residential use. Four acres of playfields are being developed. Twenty-five acres of woodland have been dedicated permanently for the use of residents, and a club house has been put at the disposal of the community.

The social purposes of Chatham Village, as originally conceived, were set forth in the report of June 30, 1931:

1. To demonstrate the social and economic advantages of the large-scale planned garden homes community.

2. To demonstrate the advantages of social and economic security that are to be had from rental rather than purchase in a community managed from a long-term investment viewpoint.

3. To demonstrate that it is possible to build and operate such a community so as to yield a satisfactory investment return. The project is in no sense philanthropic. It is designed to be commercially practicable.

4. To develop new ideas and higher standards in house design and large-scale community planning.

5. Particularly to develop an appreciation of the contributions which may be made by competent site planning to large-scale hillside developments.

After more than 5 years of experience it is gratifying to be able to report that in every particular Chatham Village has fulfilled the expectation of the Foundation, both socially and economically. One measure of the economic success of Chatham Village may be found in the record of productive occupancy of its homes. Opened in the middle of a depression, every home was rented in advance of completion. The only vacancies have been short-term vacancies caused by removal of families to other cities, and for more than 2 years there has been no vacancy of any house for any period. * * *

* * * Each year, after meeting all operating expenses and requirements for amortization and other reserves, the village has produced a net yield which the Foundation feels is satisfactory and adequately justifies this employment of investment funds.

From the beginning Chatham Village has attracted and retained exactly the kind of families for whom it was built. The quality of the community, socially, has been kept at a high level. No advertising or promotion efforts have been necessary. A long waiting list is composed largely of friends of village families diagrams, all of which are platted for detached houses. It shows a park area of approximately the same size as in B and C, but provides 72 lots ranging from 2,900 to 3,000 square feet in area and costing $473.58 or, with cost of park area added pro rata, $540.84.

In these plans it is assumed that side yards will be necessary, and adequate side yards are provided in every case. The distance between houses in plans A and B is 20 feet; in plans C and D it is 16 feet; and in plan E, along the major street, it is 15.8 feet.

The 15-foot setback in plan A is retained throughout along the 40-foot streets, but along the major streets a 10-foot setback is used. In the latter case, however, the distance between building fronts remains the same, since the street was widened from 50 to 60 feet.

Whereas plan A provides lots of sufficient area for healthful housing, plans B, C, D, and E, provide more desirable arrangements from both social and economic points of view. All four patterns provide for fewer families per acre than does plan A, and at the same time make possible appreciably lower costs per lot, even (with the sole exception of plan B) when the cost of the park area is added pro rata. Economy is obtained by savings of 26.7 to 43.9 percent in street improvements, 34.8 to 43.8 percent in sewers and by assessing the cost of the central open area upon the municipality. The usual criticism of interior playgrounds is that of the expense of supervision. This may, however, be considered as having been transferred from the eliminated streets, and therefore as not being entirely an added cost.

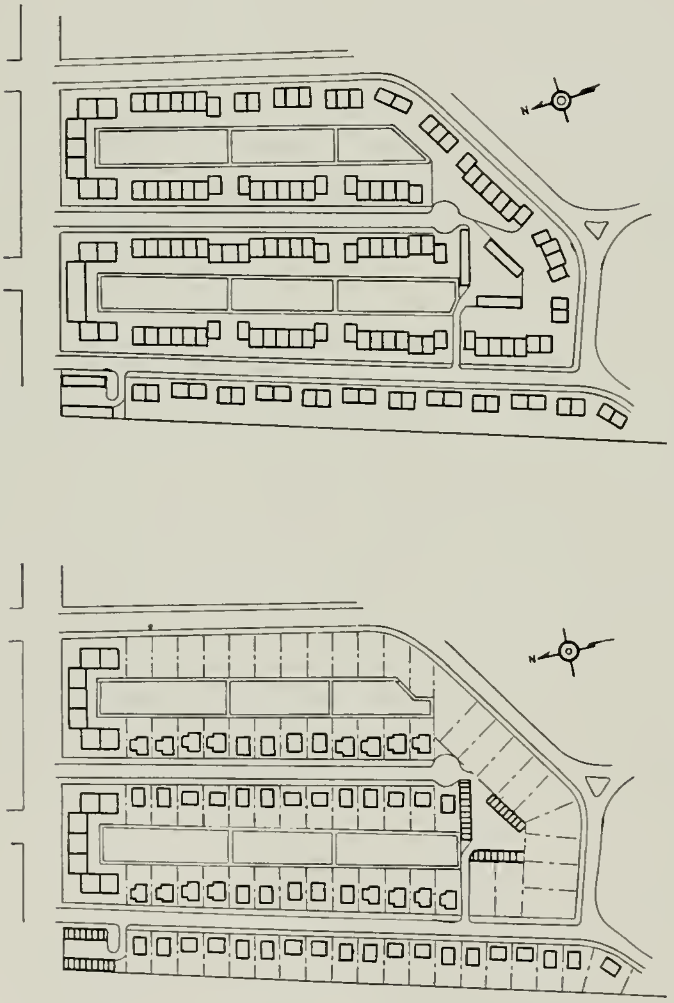

FIGURE 13.—Chatham Village, Pittsburgh: Two original studies, plan for 80 single houses, plan for 128 row houses.

The first study provides 80 six-room houses to sell at an average of $10,500. The 128 row houses shown in the second study, it was found, could be sold for between $7,860 and $9,042. The final plan followed the latter arrangement, but on the basis of a rental occupancy and not sale of lots and houses. See figure 24.

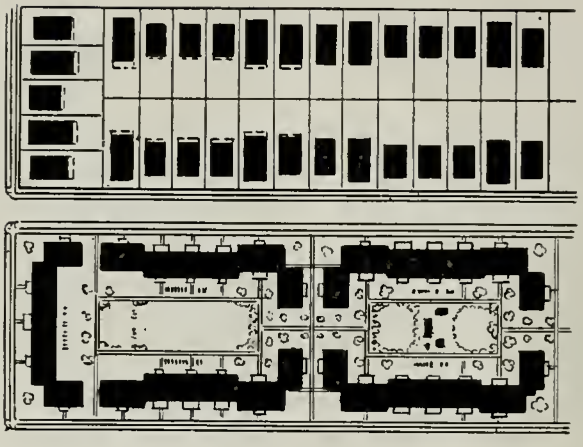

FIGURE 14.—Sunnyside, L. I., contrasted with New York City block plan.

A block of buildings at Sunnyside is contrasted with a so-called normal New York City block plan. The lower plan is at Sunnyside, uses shallow, attached, two-room-deep dwellings in both houses and flats. The upper block is the same building space as it is usually wastefully arranged in free-standing, individual buildings. The center park play space of the lower plan is about equal to the narrow side yards in the upper plan.

Larger blocks than have been customary are desirable to reduce the number of traffic intersections. Plans B, C, and E eliminate four of the street intersections of plan A, thus improving traffic conditions on minor streets.

Figures 12, 13, and 14 are indications of how the site planner's study of particular arrangements, in particular places, reveals less costly ways of securing desirable relationships. All are taken from Henry Wright's *Rehousing Urban America*,[6] figure 12 and 13 being examples from Chatham Village, and figure 14 from Sunnyside. They reveal, in a measure, how group planning assembles buildings and land for effective openness without extravagance.

Finally, there are shown different plans of the greenbelt towns, revealing (among other things) the relationships of the first town units to the ultimately expanded town, and to the sewer and water services.

Appendix

By way of illustrating the method of careful analyses of various alternatives in a planning study, there are submitted in this appendix the following:

1. A report and recommendations of the water supply and distribution system of Greenbelt, Md.
2. A portion of the reports and recommendations for heating of dwellings at Greenbelt, Md., and

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[6] By permission of Columbia University Press, 1935.

3. A list of some of the principal phases of the planning study at Greenbelt, Md., suggesting the thoroughness with which the different problems were studied.

Water Supply System, Greenbelt, Md.

Recommendations for water supply and distribution.—It is recommended that the water supply for the Berwyn project be purchased in bulk from the Washington Suburban Sanitary Commission, whose water district is immediately adjacent to the development, requiring the laying of a supply line to, and the erection of a standpipe on the high point of the property for the maintenance of storage and pressure. This supply is both ample and safe and may be distributed to the homes at a reasonable cost to the consumer. It is also sufficient for all future needs of the community, including any projected extension.

It is likewise recommended that the distribution system be laid as outlined in the following report. This layout has been designed to maintain a minimum pressure of 40 pounds on the higher portions of the terrain for satisfactory house supply and fire protection.

For economy of service, as well as for the control of usage and the prevention of waste, it is recommended that all house, commercial, and community supplies be metered. * * *

Report on water supply and distribution.—Water supply: From a careful study of the various sources of water supply available at or near the Berwyn project, it has been recommended that a connection be made with the mains of the Washington Suburban Sanitary Commission and its water used. This supply is sufficient for both present and future needs, is economically sound and, therefore, becomes the logical choice.

A series of conferences with Robert B. Morse, chief engineer of the commission, developed the recommended scheme. This contemplates bringing a 16-inch main from a point on the Baltimore Pike across to the high point on the Hurley tract, at which point a 2,000,000-gallon standpipe will be erected to serve both as storage and pressure control. From here the water will be bought in bulk, through a meter, and distributed to the various parts of the project.

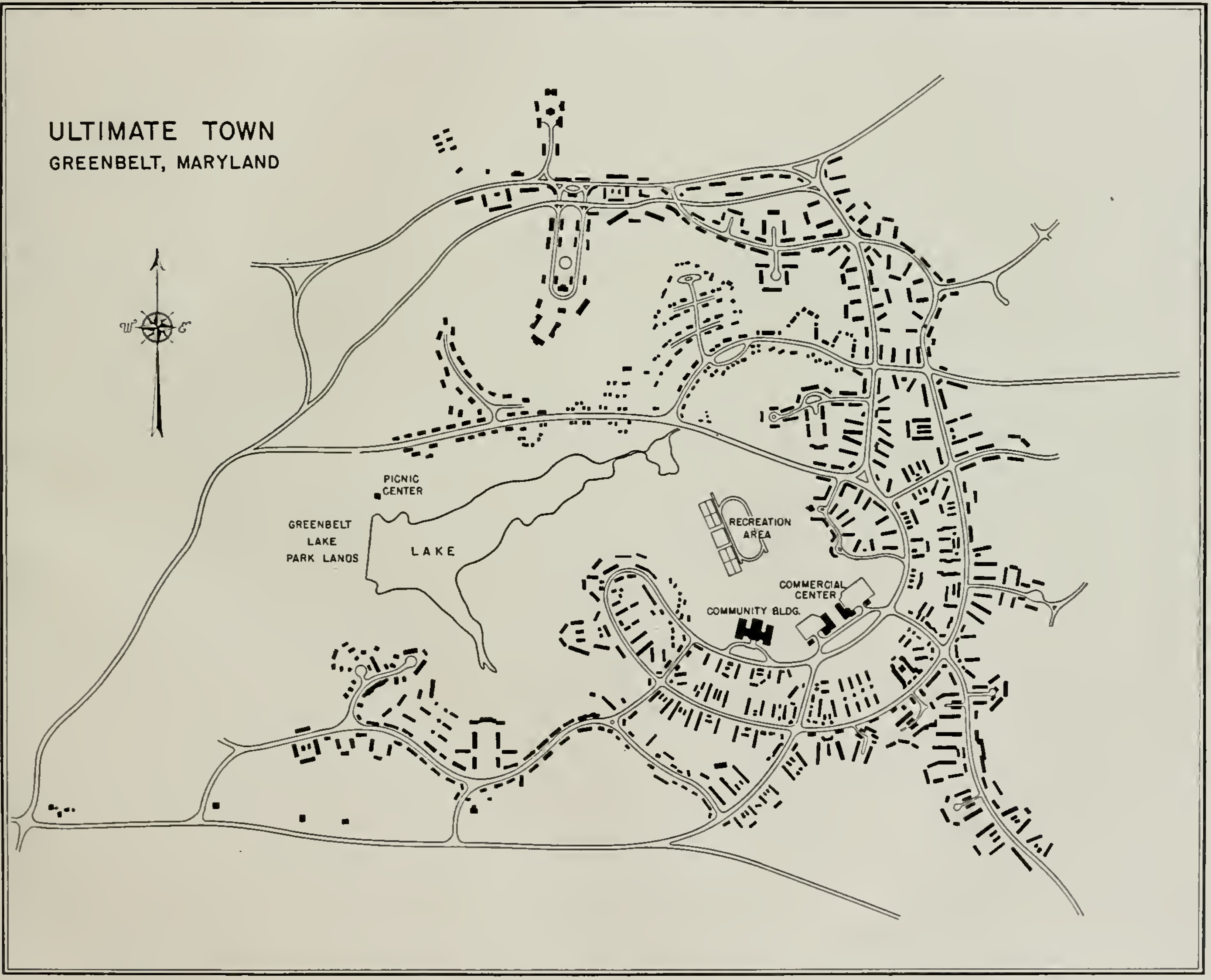

FIGURE 15.—Plan of the proposed ultimate town, Greenbelt, Md., a Farm Security Administration project.

The ultimate town of Greenbelt, 3,000 dwellings, is a demonstration of comprehensive planning of an entire suburban community. Designed by the technical staff of the Suburban Resettlement Division of the Resettlement Administration, it is already partially built.

Demand requirements: The immediate demand for water is based on a unit of 1,000 homes, with an average family of 4, plus such stores, schools, and other buildings as are contemplated for this community. General waterworks practice calls for a consumption of 100 gallons per capita per day for communities of this type, or an average demand for the project of 400,000 gallons per day.

For purposes of design, a demand requirement of 125 percent of the average, or 500,000 gallons per day, has been used, while future requirements, based on an additional 1,000 homes, would amount to 1,000,000 gallons. A minimum pressure of 40 pounds will be maintained at the higher points of the distribution system and an ample quantity of water will be available at all times for normal as well as for all emergency needs.

The size of the standpipe, though larger than would be required for the project itself, serves a double purpose in that it not only stabilizes the pressure and supply for the project, but also helps to maintain the pressures in the adjoining territory.[7] It also provides a wide margin of safety in case of fire.

Sources of supply: The major sources of supply, studied in connection with this project, are given below and the reasons for or against their further consideration stated.

Underground supply or wells: The entire development lies on what is known as the Coastal Plain, which is very uncertain throughout this entire area as a source of underground water supply. Wells have been drilled in the immediate neighborhood to depths of about 600 feet and have produced quantities varying from 40 to 100 gallons per minute. The uncertainty and expense as well as the limitation of this source of supply removes it from further consideration.

Surface water, i. e., Beaver Dam Creek: Beaver Dam Creek flows through the experimental farm of the Department of Agri-

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[7] An interesting illustration of the way in which a soundly conceived development may react favorably on surrounding settled areas. From an economic standpoint it has symbolic significance.

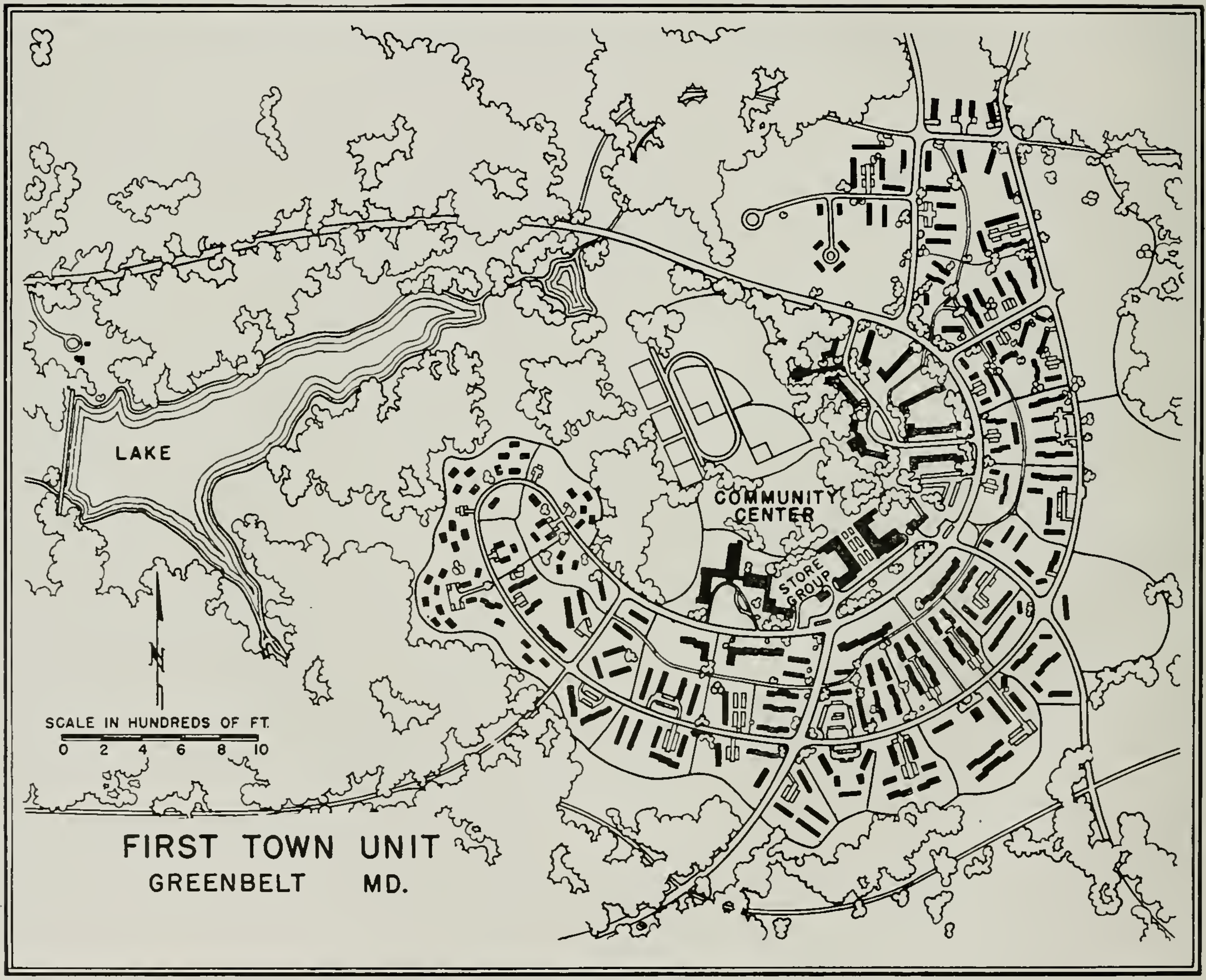

FIGURE 16.—Plan of the first unit of the town of Greenbelt, Md., Farm Security Administration project.

Approximately 1,000 dwellings, chiefly row houses but including apartments also, encircle the school, community center, store group, and recreation area. Allotment gardens lie outside the crescent plan of the street layout. Approaching roads are shown.

culture and has a drainage area of approximately 12 square miles. The normal flow of this brook at the point considered for the intake is about 4 second-feet. Three-fourths of this flow is required further downstream as dilution for the effluent of the farm's sewage-treatment plant. This leaves an available supply of 1 second-foot or approximately 650,000 gallons per day, which is more than enough for the first unit.

In times of drought, such as were experienced in 1931, there would be no water available from the creek and any expansion of the project would find this supply totally inadequate. In either case the proposed lake on the project would have to be used as a supplemental reservoir and at times as the sole source of supply. Both Beaver Dam Creek and the lake would require the most complete chemical treatment and filtration, necessitating the continuous attendance of a technically trained operator. An elevated storage tank of 500,000 gallons would also be required on the high point of the Hurley tract.

Because of the uncertainty of this source in times of drought and the known insufficiency in the case of further expansion of the project, it is deemed inadvisable for further consideration.

Washington Suburban Sanitary Commission: The Washington Suburban Sanitary Commission's water district is immediately adjacent to the project, and the future extension of their district would probably include the entire development. Their supply of water is ample for both present and future needs and seems, under all circumstances to be the logical source from which to draw. There are two places along the mains of the commission where suitable connections can be made, each of which will be discussed separately.

At the junction of the Edmonston and Branchville Roads: The commission's nearest main is laid to within 2,600 feet of this point, and could be extended to there by them to feed our system.

Owing to the present location of this main along the high ground of Berwyn Heights, it would be necessary to build a 500,000-gallon clear water storage reservoir near this corner in order to have a sufficient supply to carry over the periods of heaviest usage. It would also be necessary to install a booster pump at or near this reservoir and erect a 500,000-gallon elevated

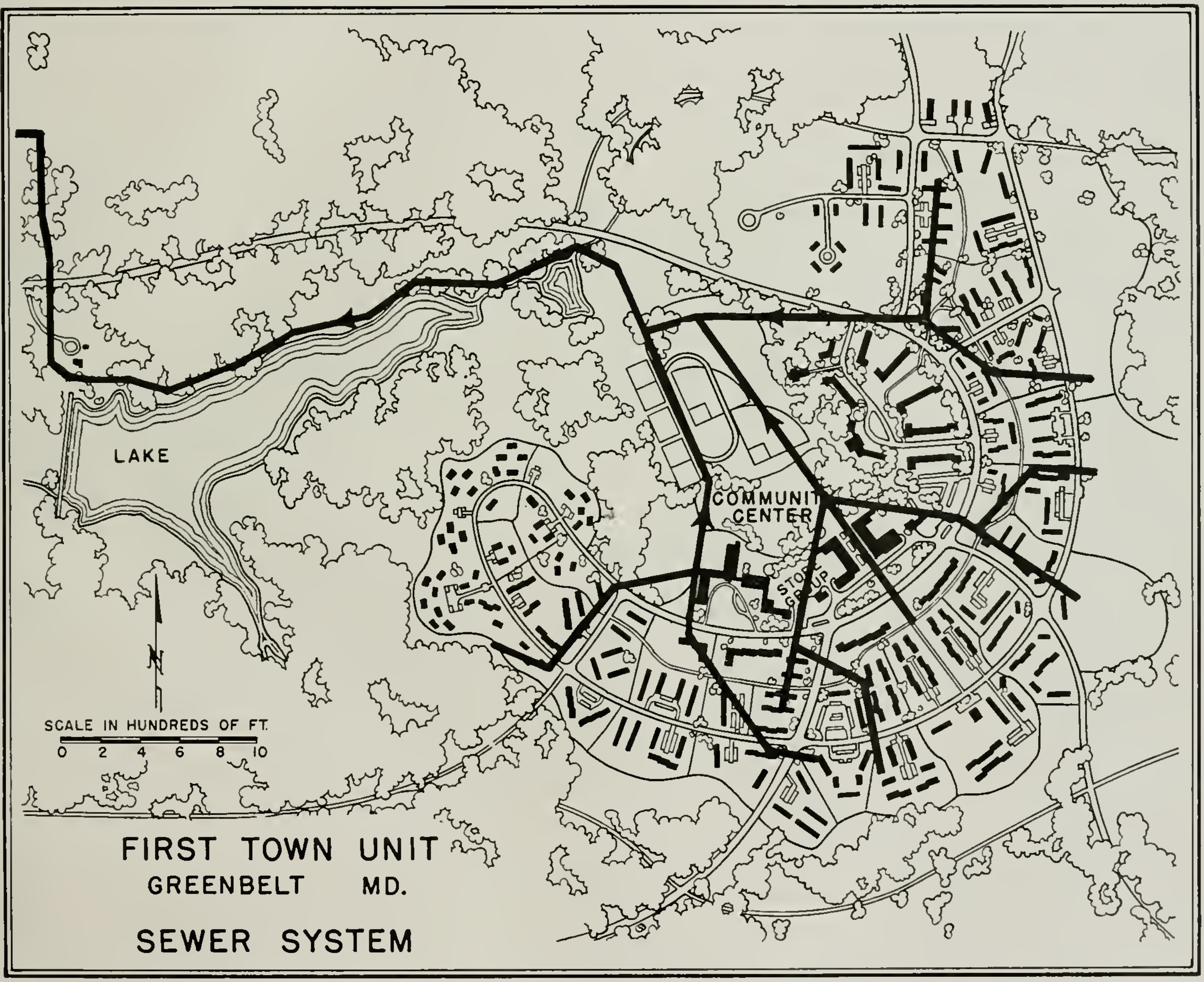

FIGURE 17.—Main trunk sewer system of the first unit of the town of Greenbelt, Md., Farm Security Administration project.

The sewers follow as directly as possible the fall of the ground and do not follow the street pattern. The capacity is ample for additional dwellings. In a town of tenant occupancy nothing prevents running utility lines across lots.

storage tank, on the high point of the Hurley tract, from which the distribution system will be run. This elevated storage tank is required to maintain the proper pressures in the lines and provides slightly more than 1 day's supply for the first unit. This line from the junction of the Edmonston and Branchville Roads to the Hurley tract, with its appurtenances, would necessitate a continuous operating and maintenance charge which would have to be added to the purchase price of the water. A cost to consumer comparison, given below, shows this to be more expensive than the recommended scheme.

Sixteen-inch main from Baltimore Pike to Hurley: One of the large water mains of the Washington Suburban Sanitary Commission follows along the west side of the Baltimore Pike. By making a connection at a point known as Edgewood, a 16-inch main can be run approximately due east to the road leading from the experimental farm to the project, and thence along this road to the high point of the Hurley tract, a total distance of 12,000 feet. This scheme calls for the erection of a 2,000,000-gallon standpipe at this point, from which the distribution system will be run.

Under this plan it is contemplated having the main laid, the standpipe erected, and a meter installed by the commission, but financed by the Resettlement Administration, and with the understanding that no taxes, assessments, or charges, other than the purchase price of water, will be made against the project, either now or in the future. It is also understood that all maintenance and replacements of the main, standpipe, and meter will be borne by the commission. The 2,000,000-gallon standpipe, though larger than would be necessary for the project itself, serves the double purpose of maintaining a constant pressure and supply for the development and for the adjacent territory of the water district. It also has the invaluable asset of being an ample supply for fire protection or other emergencies. A further point of interest lies in the fact that a reduction in the size of the tank from 2,000,000 to 1,000,000 gallons would bring a saving of only about $10,000.00, while reducing greatly the factors of safety in both supply and fire protection.

As shown by the data given below, this scheme provides not only the most satisfactory supply for both present and future

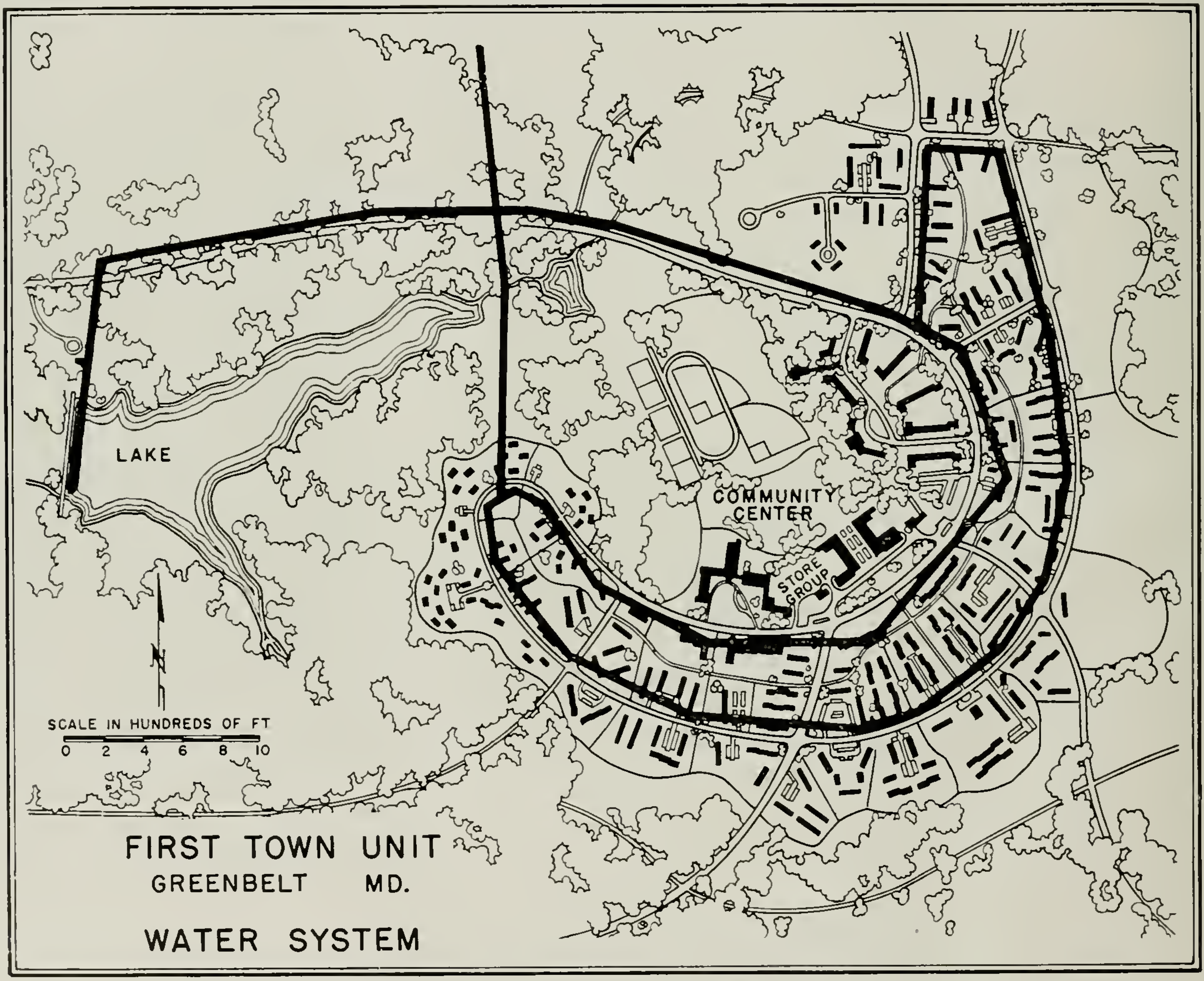

FIGURE 18.—Main trunk water system of the first unit of the town of Greenbelt, Md., Farm Security Administration project.

The system is designed to service additional dwellings. The storage tank is at the extreme north point. The line southward crosses a shallow valley to another high point at the tip of the crescent.

needs, but is economically sound when figured on the basis of cost to the consumer.

Distribution system: Owing to the fact that the development lies largely along the higher ground, and the necessity of bringing the water to the various parts of the tract with as little loss of pressure as possible, it has been recommended to lay a principal loop of 14-inch cast iron from the meter on the high point of the Hurley tract through the first unit of houses. From this main will be taken other portions of the distribution system to completely service the entire project.

Distribution mains—Fire hydrants: The distribution mains lead directly from the meter at the standpipe through the 14-inch loop previously mentioned, and into a secondary loop of 8-inch cast-iron pipe cross-connected at the end of each block to form a complete grid. This method insures the greatest uniformity of pressure and supply, and the least interruption of service at such times as repairs or maintenance work may be required. The size of all these lines is kept within the limits recommended by the American Water Works Association and the National Board of Fire Underwriters as proper for connections to fire hydrants. These hydrants will be spaced not only according to the recommendations of the above mentioned authorities, but also as strategically as possible in relation to the house groupings in each block.

An additional main will be carried to the sewage-treatment plant and a branch laid across the dam to serve as a connection to the future development of the project. This line across the dam should be laid during construction, as it would be very difficult to put it in this location at a later date.

The size and location of the mains as designed for the first unit are such that they may be connected at the proper places and supply the future extension of the project for both normal use and fire protection. The necessary fixtures for such connections are provided in the present lay-out.

House service lines: Owing to the group arrangement of the houses in the various blocks, the usual method of connecting

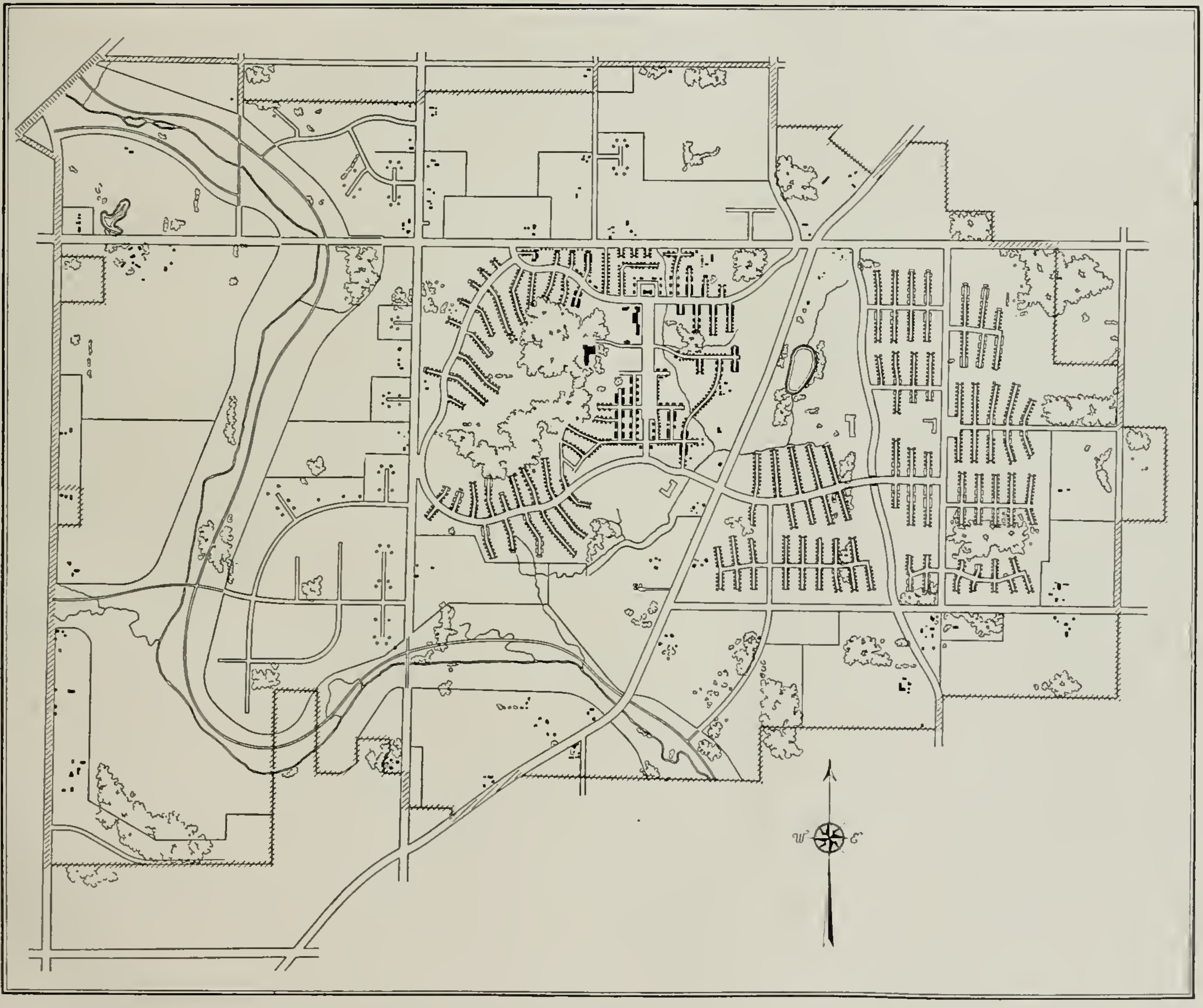

FIGURE 19.—Plan of the proposed ultimate development of Greendale, Wis., Farm Security Administration project.

This comprehensive land use plan, by the Suburban Resettlement Division of the Resettlement Administration, differentiates: the first town unit, future town units, land reserved for future suburban development of larger dwellings, small farmsteads, farms, allotment gardens, park areas including the stream and valley parkway of the Milwaukee regional plan, woodland, and wooded shelter belt. The project is partially built.

each house directly to the main has been found unsatisfactory and uneconomical. Careful studies are, therefore, being made of each block, and spur lines and loops are designed to supply one or more groups of houses in the most economical arrangement possible.

Pressure: The minimum pressure at the higher point of the system should never be less than 40 pounds under normal conditions, as recommended by the American Water Works Association.

Water meters: In order to make the cost of water to the consumer as low as possible, it is essential that all uses be kept under control. The only satisfactory method of doing this is through the use of meters for all services, whether they be domestic, community, or commercial. Unmetered service invites waste, as has been amply proved through studies in all parts of the country. This waste would require an increase of at least 50 percent in the average charge to the families.

The proposal to furnish hot water for domestic use adds a complication to this meter control as it would be out of the question to install two meters in each house and to have the hot water apparently "free" would tend to make its use excessive. A possible solution to this would be the installation of a meter on the feed water line to the heating unit and in this way control the prorated charges for the domestic hot water.

In any event, all water for community and commercial use should be metered in order that the proper charges can be made.

Cost of water to the consumer: As shown by the supporting data which follow, the cost of water under the recommended plan would be at the rate of $0.18 per 1,000 gallons until a write-off can be made of the cost of the supply line and standpipe, after which the charge should be reduced to $0.12. This would mean a monthly charge of about $1.09, which would later become approximately $0.73. These charges will remain practically unchanged with any increase in the project, and could not be reduced by any appreciable amount should it be determined to limit the project to the first unit only.

Supporting data: For purposes of comparison, estimates of cost of the various water supplies are given and the methods used for computing the cost to the consumer. An estimated cost of water to consumers in the territory adjacent to the project is also given.

I. Supply

a. Underground supply or wells.—As previously stated, the uncertainty, limitation and expense of this source makes further detailed studies unnecessary.

b. Surface water, i. e., Beaver Dam Creek:

Cost of installation		$50, 000. 00
Operating cost per year, including operators, chemicals, power, etc	$7, 550. 00	
Maintenance @ 5 percent on $50,000	2, 500. 00	
Depreciation, figured on 20-year replacement, @ 5 percent on $50,000	2, 500. 00	
Annual cost (without interest)		12, 550. 00
Cost over 20-year period (without interest)		251, 000. 00
Charge against cost of water, per 1,000 gallons		. 07

c. Washington Suburban Sanitary Commission:—

1. *At the junction of the Edmonston and Branchville Roads:*

Cost of installation		78, 746. 00
Operating cost, pumping station	$4, 150. 00	
Maintenance @ 3 percent on $78.746	2, 400. 00	
Depreciation, figured on a 20-year replacement @ 5 percent on $78,746	3, 960. 00	
Annual cost (without interest)		10, 510. 00
Cost over 20-year period (without interest)		210, 200. 00
Charge against cost of water, per 1,000 gallons		. 06

2. *Sixteen-inch water main from Baltimore Pike to Hurley:*

12,000 feet 16-inch main @ $4.50 per foot, in place	54, 000. 00
2,000,000-gallon standpipe	40, 000. 00
Meter charge	500. 00

I. Supply—Continued

2. *Sixteen-inch water main from Baltimore Pike to Hurley*—Contd.

Total cost—all maintenance, operation charges, assessments, taxes, etc., assumed by the commission	$94, 500. 00
Annual charge to write off cost over 20-year period (without interest)	4, 715. 00
Charge against cost of water, per 1,000 gallons	. 03

II. Distribution system

Estimated cost of installation		52, 000. 00
Maintenance @ 3 percent on $52,000	$1, 560. 00	
Depreciation, figured on 50-year replacement, 2 percent on $52,000	1, 040. 00	
Annual cost (without interest)		2, 600. 00
Charge against cost of water, per 1,000 gallons		. 01½

III. Cost of water to consumer, per 1,000 gallons

a. Surface Water, i. e. Beaver Dam Creek.

Cost of water at source	0. 00
Charge for supply lines, etc	. 07
Charge for distribution system	. 01½
Charge for interest	. 02½
	. 11
Contingencies and sinking fund	. 02
Base charge to consumer	. 13

b. Washington Suburban Sanitary Commission:—

1. *At the junction of the Edmonston and Branchville Roads:*

Cost of water at source	0. 08
Charge for supply lines, etc	. 06
Charge for distribution system	. 01½
Charge for interest	. 02½
	. 18
Contingencies and sinking fund	. 03
Base charge to customer	. 21

2. *Sixteen-inch main from Baltimore Pike to Hurley:*

Cost of water at source	0. 08
Charge for supply lines, etc	. 03
Charge for distribution system	. 01½
Charge for interest	. 02½
	. 15
Contingencies and sinking fund	. 03
Base charge to consumers	. 18

(a) *Sixteen-inch main at end of write-off period:*

Cost of water at source	0. 08
Charge for supply lines, etc	. 00
Charge for distribution system	. 01½
Charge for interest	. 01
	. 10½
Contingencies and sinking fund	. 01½
Base charge to consumer	. 12

IV. Cost of water per month per family

a. Recommended system and supply.—Household use—4 persons @ 50 gallons—200 gallons per day, or 73,000 gallons per year:

73,000 gallons @ $0.18 per 1,000		13. 14
Average cost per month		1. 09½
Minimum monthly charge for metered service		1. 00
At the end of write-off period of 20 years:		
73,000 gallons @ $0.12 per 1,000		8. 76
Average cost per month		. 73
Minimum monthly charge for metered service		. 70

b. Cost to consumer in Washington Suburban Sanitary District:

Charge per 1,000 gallons		0. 22
Yearly charge per front-foot of property		. 14
Property tax per $100		. 07
73,000 gallons @ $0.22 per 1,000	$16. 06	
60 front feet (assumed) @ $0.14	8. 40	
$3,500 (assumed) @ $0.07 per $100	2. 45	
Total cost per year		26. 91
Average cost per month		2. 24

c. Unmetered service under recommended system and supply.—As previously stated, due to the waste of water in unmetered systems, the calculated charge should be increased by 50 percent, thereby making the monthly charge for water $1.65.

V. *Comparison of costs—Recapitulation*

Beaver Dam Creek not included for reasons previously stated. Source of supply—Washington Suburban Sanitary Commission.

	Edmonston and Branchville Roads	16-inch main from Baltimore Pike
First cost for supply	$78,746.00	$94,500.00
Total cost per 1,000 gallons to consumer	0.21	0.18
Average monthly charge to consumer	1.28	1.09½

Recommendation I.—With respect to the families living in the three-story multiple-family groups, it is recommended that the water distribution piping and the meters be so arranged that each building be controlled by either one or two meters so that control can be had by the management of the water consumed in each building.

Recommendation II.—With respect to selecting a group of dwellings in which the water distribution will be so arranged that the group of dwellings can be operated by the management without meters, it is recommended that group VII, buildings 26 and 32, area A, be selected for such operation; that the total water to this group be metered so that comparison of the water consumption of this group can be made with that of other similar groups; that connections be made for meters to the individual family dwellings, so that installation can be made at any time by the management.

Heating System, Greenbelt, Md.

Heating in relation to family and community.—Because the average layman may overlook the significance of the problem of house heating in a housing project such as this, we wish to emphasize the fact that a solution of the problem can be reached only after considering many factors. The effect of the installa-

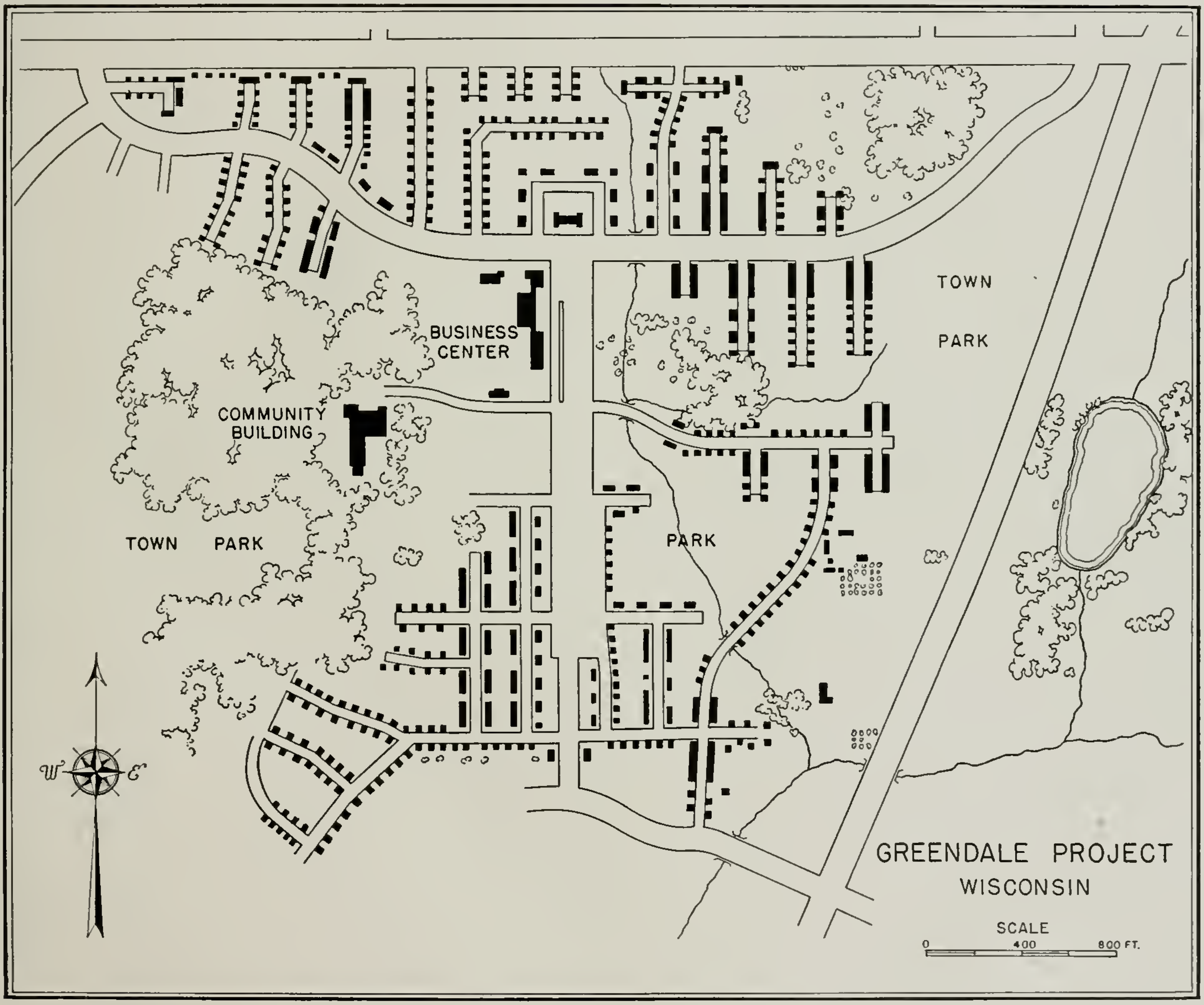

FIGURE 20.—Plan of the first town unit of Greendale, Wis., Farm Security Administration project.

The first unit of 750 dwellings has, chiefly, detached single houses, but includes row houses also. The community building (school) is withdrawn from the main street and business buildings. The street layout differentiates between roadways for practically no traffic as in the case of cul-de-sac, secondary roads with somewhat different dwelling frontage, and main thorofare for traffic movements on which no dwellings front.

tion method and the effect of the choice of fuel have a bearing upon family and community life, apart from the question of cost. The principal points to be noted are:

a. That housing management will be facilitated if individual families are placed upon substantially the same basis in receiving heat and domestic hot water, whereas added difficulties would be faced if each family were to handle the equipment and fuel and ashes (if any) with complete freedom and little effective responsibility to the interests of the community;

b. That the delivery of coal to, and the removal of ashes from, all the individual dwellings would be less desirable than such services for a fewer number of plant installations, and they would be even less desirable than the condition where a cleaner fuel is used and no ash removals at all would be necessary;

c. That a comparatively smoke-free atmosphere is not only an aesthetic and health factor, but will involve also less family labor in cleaning and laundering.

Construction to accommodate heating installation and fuel.—The costs for initial construction, and the costs of the maintenance and repair of that construction which will arise as the result of the choice of installation method and fuel, are outlined below. It is the construction involving these costs which must be shown upon, or omitted from, the drawings which now await completion. Three important decisions must be made.

a. Whether one cellar and chimney stack shall be provided for each group of dwellings, or whether there shall be a cellar and chimney for every dwelling.

Comment: Taking as a basis the plans of dwelling unit types which we have planned to date (and which have been tentatively approved by us and by Consultant Clarence S. Stein), there would be one cellar and chimney required for a multiple-group unit heat installation, as against several cellars and chimneys for the individual-dwelling unit installation. Obviously, the capital outlay for construction would be greater for the greater number

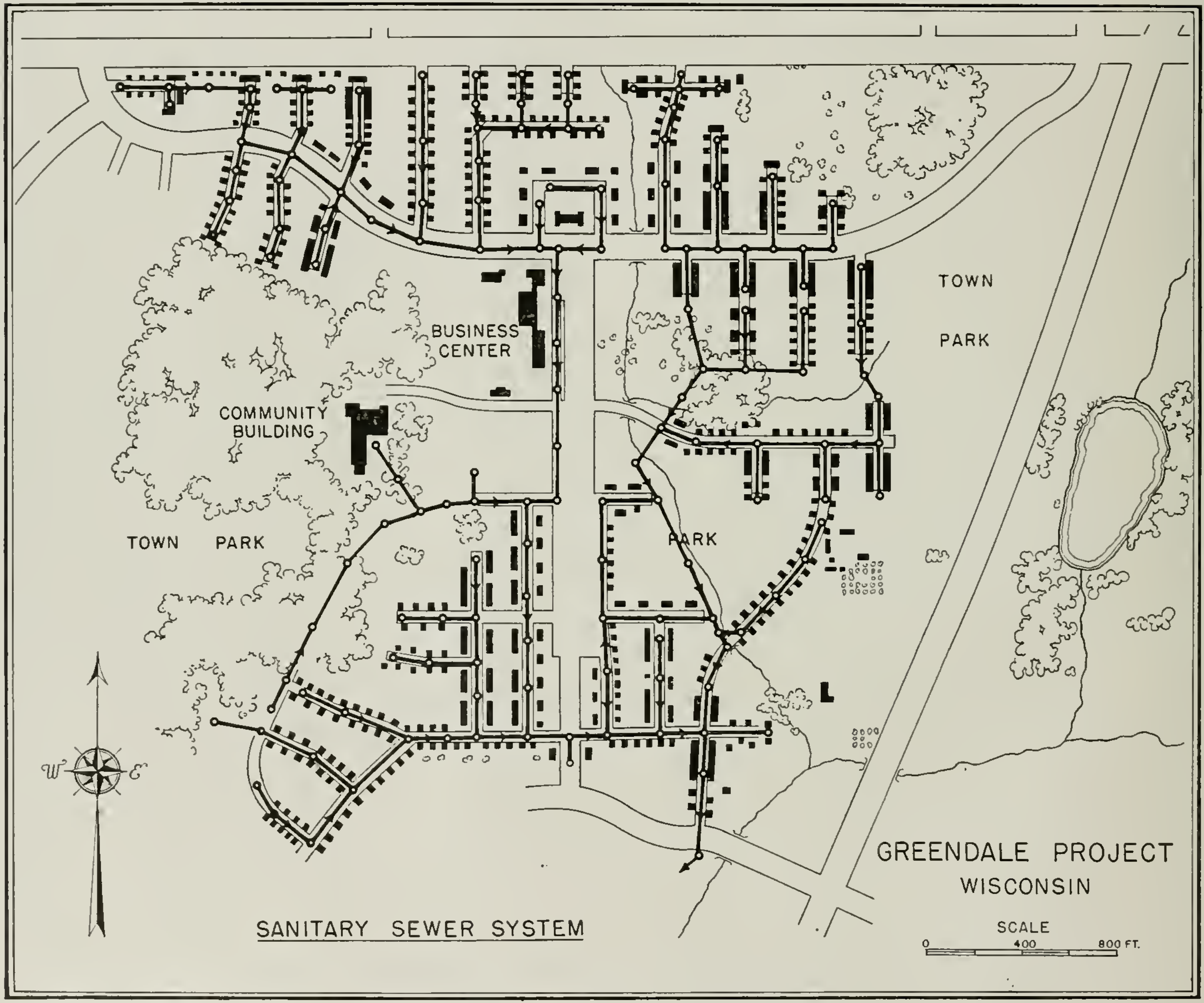

FIGURE 21.—Sanitary sewer system of the first town unit, Greendale, Wis.

The sanitary sewer system is in general a normal layout, following the street system, but also including a line following the small watercourse. Compare this layout with that for Greenbelt.

of cellars and chimneys. In either case, however, the charge to the tenant for the maintenance and repair of the cellars and chimney stacks would be practically negligible.

No serious problem of exterior design is involved in this decision.

b. The extent to which subsurface drainage will be required as a result of building cellars.

Comment: Owing to the presence of subsoil water in certain sections of the site, the building of cellars will require installation of subsurface protective drainage, and the building of every cellar implies installation of a drain in each. If there are cellars under every dwelling the installation cost of protective drainage will be greater than if fewer cellars are provided. The maintenance and repair of subsurface protective drainage need not be calculated; but floor drain maintenance and repair charges would be greater for the larger number as against fewer cellars, particularly if the hazard of tenant carelessness is considered.

No problem of exterior design is involved in this decision.

c. Whether a more extensive provision of paved service roadways will be undertaken to facilitate fuel delivery and any ash removal for all individual dwellings as against the minimum service roadways needed in the case of multiple-group unit installation of heating equipment.

Comment: We are recommending a very brief holding in abeyance of your decision upon the kind of fuel to be used. Nevertheless it is essential to present at this time the construction and maintenance costs which will be involved in providing for delivery and storage of any fuel which may be considered. Our analyses up to the present moment indicate that the choice of fuel might be either coal or oil.[1]

The delivery of coal and removal of ashes (whether to a multiple-group unit installation or to every dwelling) would necessitate considerable addition to the now planned economical layout of service driveways. At the present time it is practically impossible to make any accurate estimate of the amount of addi-

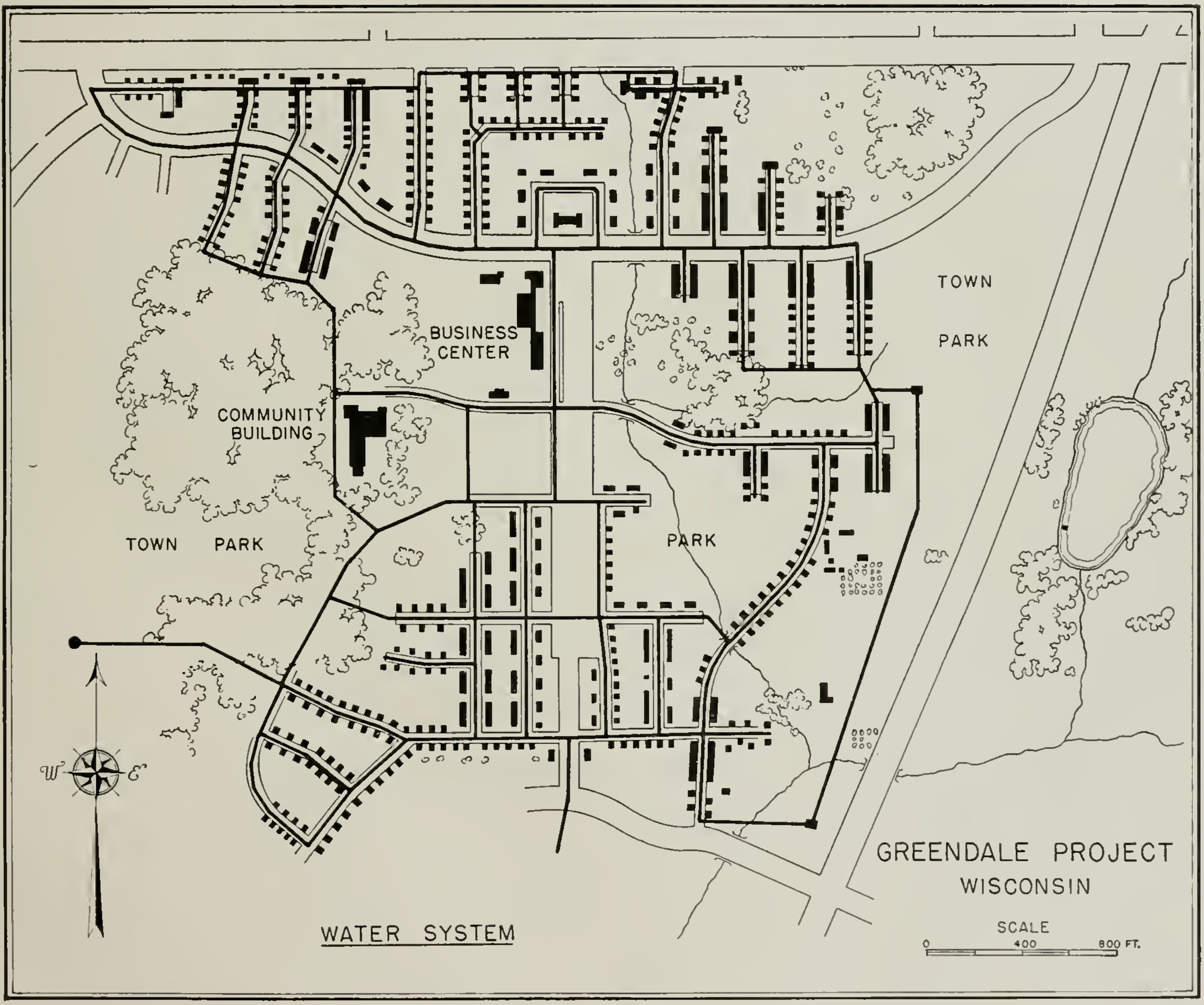

FIGURE 22.—Water system of the first town unit, Greendale, Wis.

Wells are located at the eastern edge of the layout, water tank at the western edge.

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[1] Note that oil was finally selected.

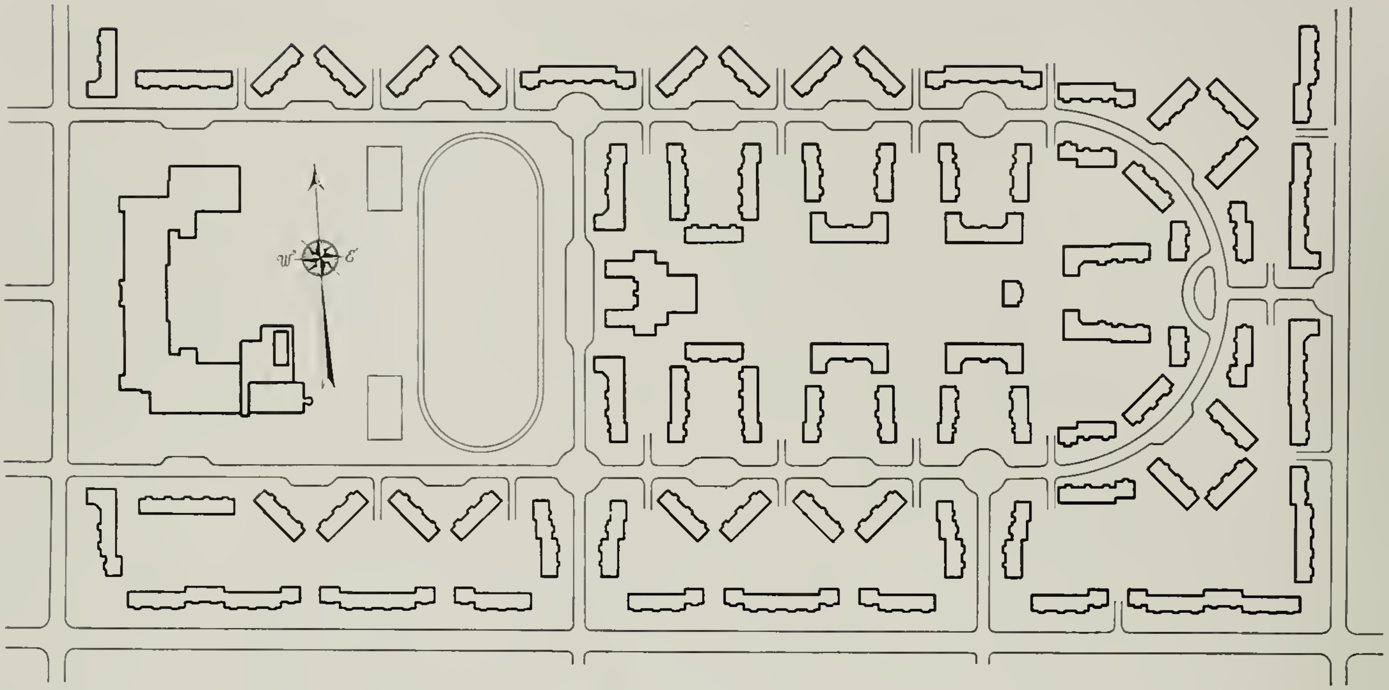

FIGURE 23.—Plan of Kenfield, Buffalo, N. Y.

The 65-acre plot on the outskirts of the city surrounds the Kensington High School on three sides. The site plan provides for a 6-acre playground directly behind the school and centrally located for children living in the project. Twenty acres are held vacant for future growth of the project. The 3-story apartments, 2-story row houses, and 2-story flats in Kenfield have 2,756 rooms accommodating 658 families.

tional paving required for the accommodation of this type of fuel, but obviously more paving would be required for separate heating units in each dwelling than for a multiple unit heater in one cellar of a group. The installation and maintenance costs of such pavement vary with the type of construction, and no estimates can be given now. However, the tenant may be expected in his rental to cover at least his individual share of the maintenance costs.

Over and beyond the question of costs, there is objection to the added service roadway pavement mentioned above, because it will tend to reduce the usefulness of the service yards to the various families, and because there is likely to be some loss also in attractiveness.

In the use of oil the additional service driveways would not be required, since the oil would be stored in underground tanks within easy filling distance of the garage driveways. Therefore no additional construction and maintenance charges would be involved.

Obviously, this latter arrangement makes for the fullest usefulness and the maximum attractiveness of the lay-out on the service side of the dwellings.

From the above comments it is obvious that additional costs would be involved if an individual heating system were installed in each dwelling rather than a multiple group unit installation, considering the decisions with respect to:

1. Cellars and chimneys.
2. Cellar drainage and drains.
3. Service driveways.

Summary of costs of installing and operating various sytems of heat and domestic hot water.—The installation, maintenance, and operation of equipment to supply heat and domestic hot water have been considered for a number of varieties of system, and for the use of alternate fuels. These considerations, which include reference to cost which must be borne by the tenant, have been assembled in a document, dated December 5, 1936, that will be kept as a record in our files, available for your files as required.

We summarize below the five principal systems which we have selected from the varieties studied, and which we believe merit consideration and comparison. We call attention to the fact that schemes D and E promise to be the most economical to install and to operate. The five schemes, and the basis of calculations for all, are covered in detail in a separate document submitted herewith as part of this report.

Summary of tentative rating of 5 heating schemes [1]

Type of installation and fuel	Rating of cost of installation	Rating of cost of operation
A. Coal, individual, hand-fired	3	3
B. Coal, individual, mechanical stoker	5	4
C. Oil, individual, automatic	4	5
D. Coal, multiple group, mechanical stoker	2	1
E. Oil, multiple group, automatic	1	2

[1] Costs range from lowest (1) to highest (5). Maintenance and replacement of equipment are calculated elsewhere under "General building maintenance."

A primary social consideration.—All of the considerations, and all of the calculations, up to this point appear to justify the choice of the systems noted in the table as D and E, i. e., a multiple-group unit installation using coal or a similar installation using oil. This implies, of course, the vending of heat to the tenants upon a presumably uniform basis as to quantity of heat. Such a proposal at once raises the questions whether the heating engineers have calculated an intensity of heating greater than an individual family might accept if under compulsion to reduce the heating to effect savings to the family budget and whether this housing project should itself accept a lower standard of heating in order to reach people of more precarious economic status.

We submit the proposition that the success of the new community as a conveniently and attractively planned town, with its protective belt of open land, will be measured in terms of physical lay-out and buildings, in terms of its social and community life, and in terms of its ability to meet the financial set-up established for it. In our judgment, the acceptance of tenants of such subnormal level of income as would be implied by this present discussion might jeopardize the success of the entire experiment—particularly when consideration is given to those effects upon the community which have already been discussed. We do not believe that this first community experiment can safely be directed to meeting the needs of the lowest income groups; we cite your desire to have the community a "tax paying participant in the region" when future housing has been added to that which is to be built now. However, we suggest that those with experience in management be asked to submit an opinion upon this basic social-economic question.

Conclusions: Inasmuch as all the considerations of cost, convenience, and amenity which are mentioned herein point to the choice of a heat and domestic hot water installation on the multiple-group unit system, inasmuch as the cost analyses contained in exhibit No. 1 are in fact the foundation of the cost portion of this report, and inasmuch as our consulting heating engineers have reviewed and approve these analyses and the conclusions arising out of them, we submit the recommendations of this report.

[The decisions on March 6, 1936, did not cover the heating of multi-family buildings, but only the twin dwellings and dwellings in rows. The consulting heating engineers concurred in this decision. The proposals and the reasons therefore are as follows:]

Recommendation No. 1.—a. That hot water circulated through direct cast-iron radiation be used for heating the dwelling units of the present building program (except in buildings Nos. 21, 22, and 23, group V of area D as noted in paragraph B of this recommendation, and as described later herein).

b. That buildings Nos. 21, 22, and 23, group V of area D be provided with heat by installing split systems, combining direct radiation and recirculated warm air, as described later herein, and as approved verbally by Major Walker, Chief of Management Division, to be a test and demonstration.

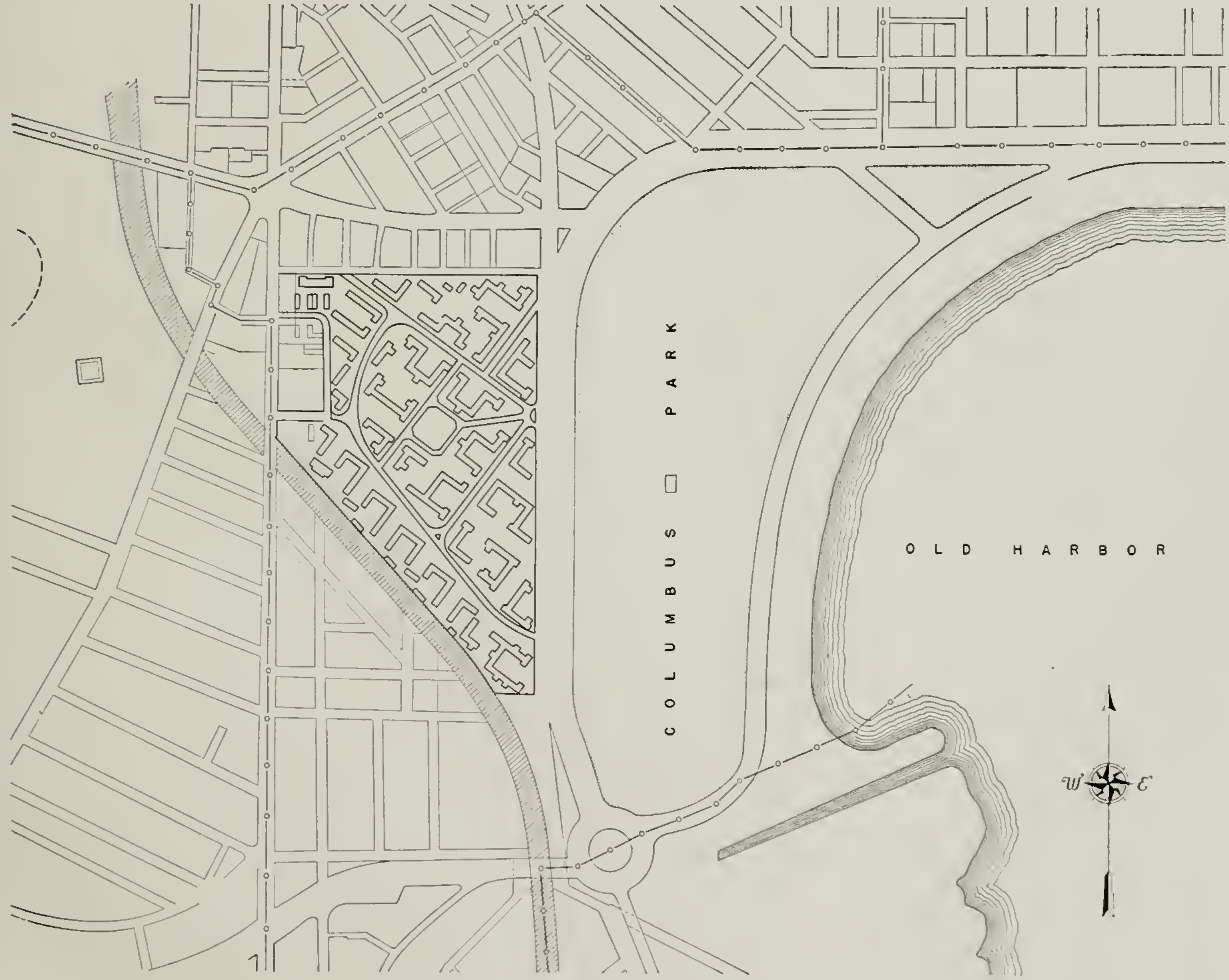

FIGURE 24.—Site plan of Old Harbor Village, Boston, Mass.

The plan shows the relation of the project to adjacent Columbus Park. See frontispiece for an air view of the project.

c. That the Management Division be officially advised of the test and demonstration installation in buildings Nos. 21, 22, and 23, of group V, area D; be requested to conduct and observe the results of the test and demonstration and report thereon to the Director of this Division; and that recommendations be then made relative to the adaptability of this method of heating to housing built in this community under a future building program.

d. That pending further development of the plans for the multiple-family dwellings and the further study of the heating problem for these groups, there will be presented for the consideration and approval of the Director a recommendation on this phase of the mechanical installation for these buildings in the near future.

Recommendation No. 2.—That oil be used as a fuel for firing the automatically controlled heating boilers, which will be installed with multiple-group unit heating systems for the dwelling units of this project.

Determining factors governing recommendation No. 1.—That the selection of the medium for heat distribution (such as steam, hot water, or hot air) shall take into consideration:

a. Uniformity of heat and regulation of temperature in dwelling units as affecting health of tenants.

b. Efficiency and simplicity of operation.

c. Economy of cost as affecting installation, maintenance, and operation.

That the selection of the type of heating system shall be based on conservative practical engineering experience in residential heating.

That consideration shall be given to providing an opportunity for employment of the greatest amount of field labor consistent with the total cost of the installation.

That the recommendation of heating systems for the dwelling units shall provide installations which may serve as a basis for conducting comparable tests and demonstrations available for consideration for any housing built in this community under a future building program.

Comment: The circulation of hot water through direct cast-iron radiation most readily conforms to the above program, because it can be economically circulated at minimum temperatures required for heat comfort within the dwelling units as related to variations of climatic temperatures.

Due to the lower temperatures at which hot water can be circulated this medium has less tendency to dry out the air than steam which must be kept at higher temperature in the radiators

Hot water provides a constant even heat at whatever temperature is required for predetermined room comfort and will be regulated by out-of-door thermostat to prevent excess tax on system due to neglect on the part of tenants.

The installation of piping and radiators will provide a greater proportion of field labor to cost per dwelling unit than other types of systems considered, such as circulated hot air systems which are factory-assembled.

The results of our investigations of the partial air conditioning heating units, which operate by means of a blower recirculating air heated by a single hot water radiator in the apparatus, were such that we feel that this type of heating should not be excluded from this present consideration. This conclusion is based on the advantages indicated by the cleaning and humidifying the air in winter and also by the opportunity to introduce recirculated air through the dwelling units during hot weather.

Because this type of heating for small houses is a recent practical development of the heating industry, which promises to provide greater living comfort for occupants, we have recommended its installation in one group of area D where its installation costs and adaptability can be carefully checked for multiple-group heating systems.

Comparative estimated costs.—Since the prorated cost of boiler and heating plant of the multiple group heating system below the first floor will be the same for either direct radiation or recirculated air units, the following comparison is based on that portion of the heating system above the connection to the dwelling unit:

1. *Heating and partial air-conditioning apparatus*

Cost of air unit complete with valve, thermostat, and extra electric circuit, switch, etc	$96.00
Piping, bathroom and kitchen radiators, valves, etc	40.00
Ducts	40.00
Humidity control	15.00
Waste connection and water connection	5.00
Labor	60.00
Amortization and maintenance approximately, per year, $5.00.	256.00

2. *Direct hot water radiator heating apparatus*

Radiators	$56.32
Piping	59.40
Radiator valves	18.00
Labor	120.00
Amortization and maintenance approximately, per year, $1.75.	253.72

Additional cost of operation to tenant.—The estimated cost of electric current for operating the air circulation fan would amount to approximately $4.50 per heating season based on current costing 2¢ per kilowatt-hour. This current would be measured on each tenant's electric meter and be included in his monthly electric bill.

The water costs for humidification would be negligible.

Determining factors considered in arriving at recommendation No. 2.—That the fuel used must be of a type which will not require:

a. The constant services of a janitor or fireman in the buildings.

b. The building and maintenance of additional service roads in order to deliver fuel to points of storage in buildings.

c. Require extra maintenance service for removal of residue.

That the fuel used shall be of a type that:

a. Can be readily obtained at a reasonable price.

b. Can be conveniently and safely stored in such quantities as will preclude any interruption of heating service.

c. Can be easily handled in delivery without damage to property or inconvenience to tenants.

d. Can be fired efficiently and automatically at all times.

e. Can be fired economically for the heating of domestic hot water during periods when house-heating apparatus is not in operation.

Comment: The fuel recommended meets with the above requirements most economically from a standpoint of both installation and operating costs. Based on market prices the costs of fuel oil and buckwheat anthracite coal, stoker-fired, in amounts required to fire the multiple-group unit heating systems are approximately the same.

The cost factors of handling of fuel are decidedly in favor of oil and represent a saving of cost of storage, fireman service in boiler rooms, ash removal, original installation and maintenance of additional service roads, all of which would be required if coal were used for fuel.

The estimated cost of 6½ cents per gallon for a good grade of fuel oil referred to in our recommendation of December 9, 1935, is based on market prices in this locality. If the management arranges for purchase in tank car deliveries, a saving of approximately 2 cents per gallon could be made on the above price. While purchasing fuel on this basis would involve a careful schedule of delivery at the siding, trucking costs by the management, and tanks for a moderate storage capacity for emergency, nevertheless a considerable saving in fuel costs should accrue.

Conclusion.—Inasmuch as the considerations of cost, convenience, and amenity, which are mentioned herein, point to the choice of the heating systems and the fuel herein recommended, and inasmuch as our consulting engineers have reviewed and approved these findings, and conclusions arriving out of them, we submit the recommendations of this report.

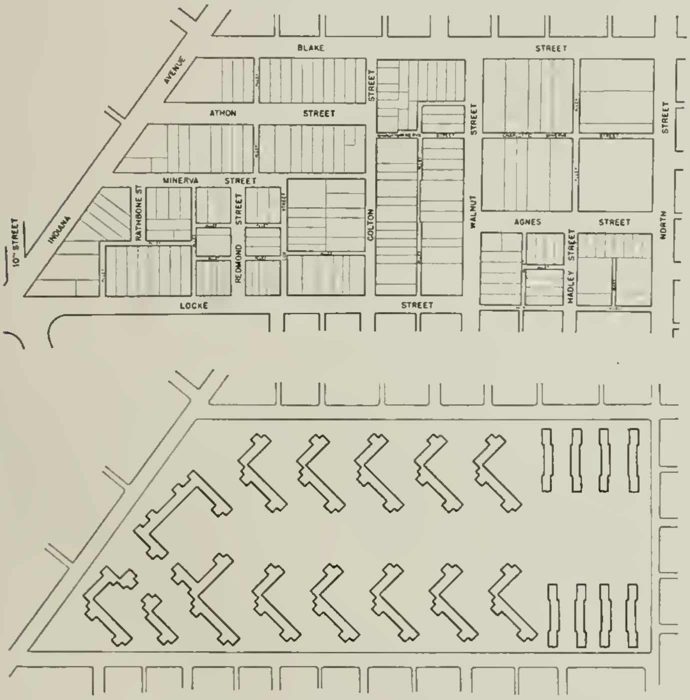

FIGURE 25.—Comparison of Original Street and Alley Layout and Site Plan of Lockefield Garden Apartments, at Indianapolis, Ind.

Replaning the 22-acre slum site eliminated many minor narrow streets, reduced building coverage to less than 20 percent, but rehoused the equivalent number of families who were living on the site prior to demolition. See frontispiece for an air view.

List of Planners' Reports and Recommendations for Greenbelt, Md.

They are given in the order of their official approval, the sequence being abnormal because planning was not done prior to initiation of construction work. Each of the items that is starred affects to a greater or less degree the site planning of the project. Either something was included or adjusted, or it was omitted, by virtue of the site planning analysis and decision.

*House heating and domestic hot water installation.
*Water system.
*Sanitary sewerage.
Electric wiring.
Lake and dam.
*Pedestrian underpasses.
*Sewage treatment and wastes: Disposal plant.
*Storm sewers.
Heating systems in dwelling units.
*Lighting, refrigeration, and cooking.
Easement limits.
*Heating systems in multifamily dwellings: Domestic hot water installation.
*Multifamily incinerators.
Water meters: Domestic hot water for dwelling units.
*Pavement widths and construction.
*Tanks for fuel oil.
*Nonresidential heating fuel and domestic hot water.
*Road pavements (revised).
Fuel oil purchase and distribution.
Electric ranges, refrigerators: Dwelling units and multifamily buildings.
*Electrical distribution and telephone systems.
*Garbage and wastes: Collection and handling.
*Business group (area L).
Telephone installation.
Budget revisions and economies.
Rural structures: Demolition.
Fire-alarm system.
*Elimination of wires near proposed inn.
*Beach—along lake.
Equipment for gasoline filling station.
*Rural dwellings.
*General development rural area.
Improvement of existing roads.
*Expansion of business center: Additional subcenters.
Disposal of sanitary sewage from rural community center.
Immediate construction of portion of sanitary sewer to serve rural community center.
Heating rural high school.
Water supply for lake recreational area.
*Fencing at sewage disposal plant.
*Recreation—General.
*Business—Industry.
Schedule of completion of town items.
Lake recreational building (revision).
Construction of fuel-oil storage and distribution plant.

III. THE SIGNIFICANCE OF SMALL-HOUSE DESIGN

By Pierre Blouke[1]

Savings in the cost of building small homes will arise from the application of a large number of minor improvements in design and equipment. Heating units, plumbing units, and other equipment have been improved to a point where notable savings are possible. New materials make simpler design possible and yet bring better results than formerly. Most architects have not been able to afford to specialize in small-house design; new interest is being shown as the possibilities are developed.

The Volume of Small-House Construction

The significance of small-house design in American housing architecture has been obscured by the capture of public imagination by large-scale housing schemes bearing promise of impressive social amelioration and by the distraction of the spectacular achievements of architects and builders in the sphere of the commercial and industrial structure. Yet the significant fact remains that the single-family, relatively low-value dwelling is the most important single form of shelter. It presents the broadest field of opportunity, the most stubborn obstacles, to the builder and designer. If the major part of American housing is to benefit from improved architectural standards and more economical methods of construction, it is this type of structure on which enormous effort and great talent must be concentrated.

The relative importance of the single-family structure in urban housing has been vividly indicated by the findings of the Real Property Inventory, a census of housing in 64 representative cities. About 6 out of 10 dwelling units in these cities were single-family houses, while about 8 out of 10 structures were single-family dwellings.[2] Nor is there evidence to indicate that the one-family structure is declining in relative importance at a significant rate. It has been estimated by David L. Wickens and Ray R. Foster that 62 percent of the aggregate number of nonfarm dwelling units built during the last 17 years were one-family dwelling units. Apartments were next in importance, accounting for 24 percent of total dwelling units, and two-family dwellings last, with 14 percent.[3] The relevant details are shown in tables II and III (pp. 41–42). These data probably give a fairly accurate idea of the situation in urban housing, but comparable information on rural housing is not available. Almost one-half of the 25,204,976 dwellings enumerated in the United States by the 1930 census were in rural areas, and the single-family structure is more predominant there than in the cities.

Most single-family dwellings have only moderate value, thereby indicating the financial limits within which the architect and builder must work. While

TABLE I.—*Number and distribution of new nonfarm dwelling units built, by type of dwelling and by period, 1920–36*

ABSOLUTE NUMBERS IN THOUSANDS OF DWELLING UNITS

	1920–24	1925–29	1930–36	1920–36
One-family	2, 001	2, 270	791	5, 062
Two-family	589	501	77	1, 167
Apartments	586	1, 088	239	1, 913
Total	3, 176	3, 859	1, 107	8, 142

PERCENTAGE DISTRIBUTION

	1920–24	1925–29	1930–36	1920–36
One-family	63. 0	58. 8	71. 5	62. 2
Two-family	18. 6	13. 0	6. 9	14. 3
Apartments	18. 4	28. 2	21. 6	23. 5
Total	100. 0	100. 0	100. 0	100. 0

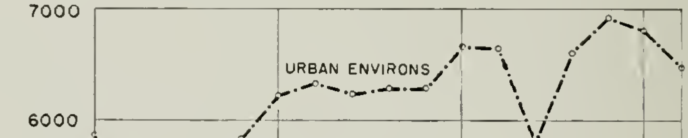

FIGURE 26.—Average cost of construction per dwelling unit, by class of city, 1920–36.

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[1] Mr. Pierre Blouke is Architect Adviser to the Home Owners' Loan Corporation.

[2] U. S. Bureau of Foreign and Domestic Commerce. *Real Property Inventory.* Department of Commerce. Washington, Government Printing Office, 1934.

[3] *Nonfarm Residential Construction, 1920–36.* Bulletin 65, National Bureau of Economic Research, September 15, 1937.

TABLE II.—*New nonfarm dwelling units built, estimated number, 1920–36*

[Thousands of dwelling units]

A—TYPE OF DWELLING

	1920	1921	1922	1923	1924	1925	1926	1927	1928	1929	1930	1931	1932	1933	1934	1935	1936
1-family	202	316	437	513	534	572	491	454	436	316	185	147	61	39	42	110	207
2-family	24	70	146	175	173	157	117	99	78	51	28	21	6	4	3	6	10
Apartments	21	63	133	183	186	208	241	257	239	142	73	44	7	11	10	28	65
Total	247	449	716	871	893	937	849	810	753	509	286	212	74	54	55	144	282

B—CLASS OF CITY

	1920	1921	1922	1923	1924	1925	1926	1927	1928	1929	1930	1931	1932	1933	1934	1935	1936
1. 120 central cities	95	192	319	393	404	431	396	355	313	203	113	83	24	17	19	51	104
2. Environs: 2,500 and over	36	71	120	152	156	166	156	157	143	90	53	38	12	9	8	20	40
3. Environs: Under 2,500	18	35	60	75	77	82	77	78	71	45	26	20	6	5	5	12	27
4 Total environs (2+3)	54	106	180	227	233	249	234	235	214	135	77	58	18	13	13	32	68
5. 96 metropolitan districts (1+4)	150	299	499	620	637	680	629	590	528	338	190	140	42	31	33	83	172
6. Nonmetropolitan urban	64	96	135	153	156	155	129	131	138	107	59	43	20	14	13	35	61
7. Total urban (5+6)	214	395	633	773	793	835	759	721	665	445	249	184	62	45	46	118	232
8. Rural nonfarm	33	55	82	97	100	103	90	89	88	64	36	28	12	9	9	26	50
9. Total nonfarm (7+8)	247	449	716	871	893	937	849	810	753	509	286	212	74	54	55	144	282

C—GEOGRAPHIC DIVISION

	1920	1921	1922	1923	1924	1925	1926	1927	1928	1929	1930	1931	1932	1933	1934	1935	1936
New England	11	20	37	45	53	60	45	44	45	28	15	14	5	4	3	4	01
Middle Atlantic	44	101	187	233	249	255	255	257	218	128	84	67	19	14	19	35	67
East North Central	50	74	134	181	191	192	186	178	160	110	37	19	5	3	4	17	37
West North Central	20	35	52	63	53	60	45	35	36	30	16	15	6	4	4	9	13
South Atlantic	37	57	83	91	106	118	101	85	81	49	29	29	13	9	9	36	58
East South Central	8	19	29	37	42	46	39	37	39	24	12	6	3	2	2	6	20
West South Central	33	56	66	66	59	64	56	63	68	59	37	24	8	7	6	16	32
Mountain	6	13	17	15	17	19	14	14	14	14	8	6	2	1	1	3	6
Pacific	38	74	111	140	123	123	108	97	92	67	48	32	13	10	7	18	39
Total	247	449	716	871	893	937	849	810	753	509	286	212	74	54	55	144	273

values do not represent costs, they do show the realm within which the architect must work. Nearly 90 percent of the owner-occupied, one-family dwelling properties enumerated by the Real Property Inventory were valued at less than $7,500, with approximately 65 percent being valued between $2,000 and $7,500. The value of the rented single-family units covered by the Inventory is reflected in their monthly rentals during 1933. Slightly less than 80 percent were rented for less than $30 per month; 94 percent, for less than $50 per month. The cost of construction of dwelling units, both single- and multi-family, to be sure, varies sharply from area to area. The data in

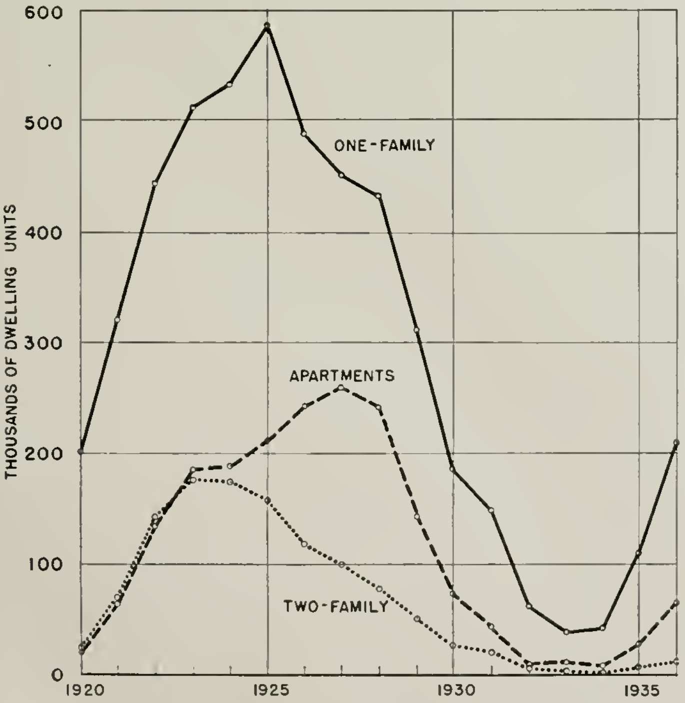

FIGURE 27.—Number of new dwelling units built by type of dwelling, 1920-36.

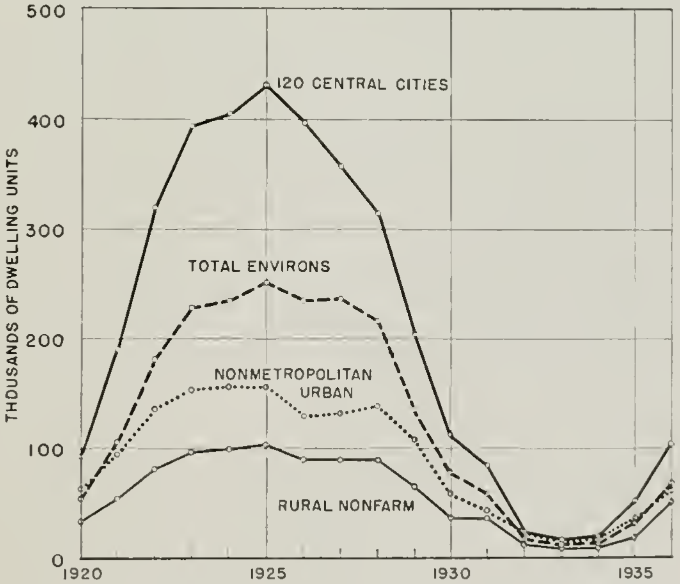

FIGURE 28.—Number of new dwelling units built by class of city, 1920-36.

Table III.—*Distribution of the number of new nonfarm dwelling units built, by class of city and by period, 1920–36*

	Number, thousands			Percentage distribution		
	1920–29	1930–36	1920–36	1920–29	1930–36	1920–36
120 central cities	3, 102	411	3, 513	44. 1	37. 1	43. 1
Environs	1, 867	280	2, 147	26. 5	25. 3	26. 4
Nonmetropolitan urban	1, 263	244	1, 507	18. 0	22. 1	18. 5
Rural nonfarm [1]	803	171	974	11. 4	15. 5	12. 0
Total nonfarm	7, 035	1, 106	8, 141	100. 0	100. 0	100. 0

[1] Excludes rural towns and villages (under 2,500 population) and unincorporated areas in environs of metropolitan districts, considered as urban.

Table IV.—*New nonfarm residential building, estimated aggregate value, by class of city, 1920–36*

[Millions of dollars]

	1920	1921	1922	1923	1924	1925	1926	1927	1928	1929	1930	1931	1932	1933	1934	1935	1936
Housekeeping units only:																	
1. 120 central cities	475	910	1, 524	1, 924	2, 086	2, 263	2, 043	1, 851	1, 612	1, 102	585	412	106	71	77	225	499
2. Environs: 2,500 and over	213	356	589	821	911	1, 036	989	978	899	569	345	254	68	57	58	139	261
3. Environs: Under 2,500	92	128	235	301	316	356	351	368	348	219	132	102	25	21	21	53	120
4. Total environs (2+3)	305	484	824	1, 122	1, 228	1, 392	1, 340	1, 347	1, 248	787	477	356	93	78	80	192	381
5. 96 metropolitan districts (1+4)	780	1, 394	2, 348	3, 046	3, 314	3, 655	3, 383	3, 198	2, 859	1, 889	1, 063	768	199	149	157	417	881
6. Nonmetropolitan urban	214	274	434	513	528	570	499	492	530	404	218	153	57	38	36	109	200
7. Total urban (5+6)	994	1, 668	2, 782	3, 559	3, 842	4, 225	3, 882	3, 689	3, 389	2, 293	1, 280	921	256	187	193	526	1, 081
8. Rural nonfarm	74	104	175	216	223	250	230	221	223	160	89	66	23	16	17	54	109
9. Total nonfarm (7+8)	1, 068	1, 771	2, 957	3, 775	4, 065	4, 475	4, 112	3, 910	3, 613	2, 453	1, 369	987	279	203	210	580	1, 191
Nonhousekeeping units	54	70	157	206	179	279	202	154	200	171	86	17	3	2	3	5	11
Total new residential	1, 122	1, 841	3, 115	3, 980	4, 244	4, 754	4, 314	4, 064	3, 813	2, 623	1, 456	1, 005	282	204	214	585	1, 202

[chart 6 (Appendix)] indicate that the largest outlay per dwelling unit is in the suburban cities while the lowest is in the rural nonfarm areas (towns and villages under 2,500 and unincorporated areas not farms). *The Financial Survey of Urban Housing* which covered 52 cities furnishes other evidence on value and rents. The average value of the one-family, owner-occupied dwellings in these cities was $4,447; of rented dwellings, $3,142. The average annual rental of one-family dwellings in these cities in 1933 was $248.

Let it not be assumed that even the most zealous efforts will remake the architectural landscape overnight. Soundly constructed new dwellings have an average life expectancy somewhere between 50 and 100 years. Since the supply of residential structures in use in this country has been expanding continually since the beginning, a comparatively small fraction of the present stock is of advanced age (only 8 percent of the housing in 64 cities covered by the Real Property Inventory was over 50 years old), and the volume of old age retirements is therefore relatively insignificant. The annual demolition and wreckage from all causes, including wind, fire, and flood, have averaged in recent years much less than one-half of 1 percent of the amount of housing in use. New construction is, therefore, the principal point at which influence may be brought to bear.

Plan and Design Values

Variations in climate and custom underlie regional differences in the general small-house pattern. The mode of life, the social structure, and the character of local materials tend to influence plan and design. Room for a degree of standardization exists, but the fidelity with which the architecture reflects the character of the people and their way of life determines the permanence, utility, and economy as well as the beauty of a style of construction. Conversely, the common error of transplanting architecture indigenous to a particular region to an uncongenial environment increases the costs of construction and maintenance and frequently produces quite bizarre effects.

In New England, where wealth was less concentrated and labor expensive, the early architecture of the Colonial period was closely adhered to by those of moderate means. The classic tradition, which found

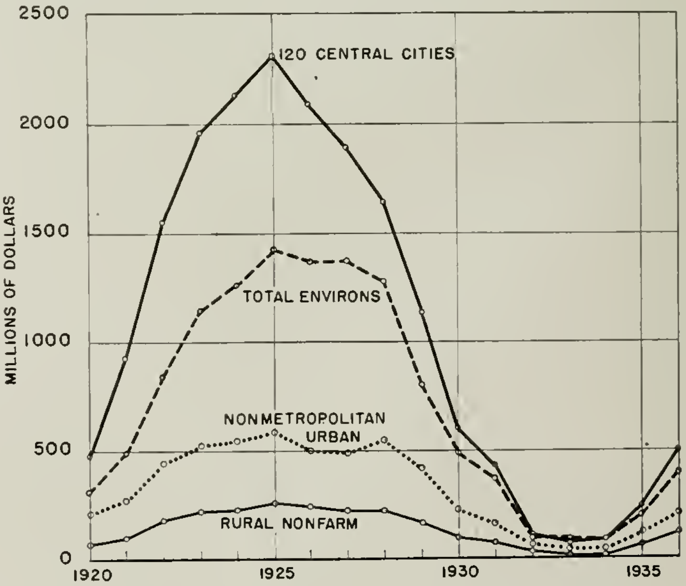

Figure 29.—Value of new dwelling units built by class of city, 1920–36.

its expression in the measured dignity of the Georgian architecture of New England and the plantation architecture of the deep south, belonged to a more elaborate manner of life.

The latter in particular required the service of many more hands than were generally available to those who were not slaveholders. The damp, hot climate of the southern seaboard was of great importance in the development of plantation life and architecture. The white man had difficulty in becoming acclimated to such excessive heat and humidity. The manner of life which he adopted was a direct result of his dependence upon the Negro for the manual labor that is necessary in tobacco and cotton farming.

The abundance of clay, the fact that unskilled slave labor could be used in making and laying brick, and the resistance of masonry to heat convection, quite naturally led to extensive use of brick in southern building.

The great variety of fine woods that were available and the familiarity of the people with their use in construction resulted in the fine forms and detail of the New England frame house—many of which are still in good condition and taste, after more than two centuries of use.

The general use of field stone in Pennsylvania was, of course, due to availability in large quantities.

The twice-transplanted architecture of the Spanish Mission settlements of the Southwest encountered a made-to-order climate, to which its traditionally thick walls, flat-pitched tile roofs, and small openings were admirably suited. The Southwest was indeed a new Spain.

The development of the Cape Cod house, like all good architecture, was based on the needs, ability and character of the people who built and lived in them. Their simplicity and fine workmanship were fundamental characteristics of the fisher folk who built them as they did their boats, for economy and service.

They were planned as they were built, a bit at a time, as need for more space developed in the family. This might be considered an extravagant method today. And it cannot be denied that such a system results in a large final cost. If, however, the family is able to procure its own home several years sooner by building only part of it in the beginning, then some additional cost may well be justified. Certainly the time and effort expended in caring for excess space for a number of years before it is needed, is a cost worthy of reckoning.

To men accustomed to the between-deck economy of space of sailing vessels, the low ceilings and duck-as-you-enter doors were quite satisfactory. Compared to ships' portholes, the small windows of the Cape Cod house were of more than ample dimensions. Of course, the heat economy combined with the high cost of glass contributed to the general adoption of small windows.

The prohibition of brick manufacture in the Colonies, which was established by Royal decree as a protection for English manufacturers, led to more extensive use of wood and stone, as well as bootleg traffic in native brick. In a similar way, the building code of today definitely influences construction practices and usage—with, it is needless to say, more admirable purposes in view.

The recent development of many new building materials, and the vast improvement in processes of manufacture, have given birth to radical variations and departures from the traditional construction of the past. Such of these new developments as lend themselves to rational analysis, and meet the approval of competent architects, should certainly be utilized fully.

Mistakes in planning and taste were costly in the past, as they are today. Time has played its part in removing much of the evidence of the errors of early architecture—which is proof of the axiom that only enduring architecture is good architecture.

Planning To Meet Requirements

The designer and builder of the small house must operate within confining economic limits. The financial limits have been suggested previously. Social considerations of another type impose other limits. In formulating policies for the improvement of housing, for example, there has been a tendency to emphasize the need for good housing as a factor in maintaining public health. But good housing without due consideration for its cost to the family may make too great inroads on the family budget. Families *can* be "oversold" on houses as well as on luxuries. Thus, there is no escaping the fact that good housing is no substitute for sufficient income. Both critics and proponents of housing development have sometimes overlooked this obvious fact, which, barring governmental subsidies, establishes a financial framework within which the designer must work if he is to meet the requirements of decent housing. It follows that lenders and builders have an obligation to make appropriate economic analyses to the end that housing shall not be too great a burden on the prospective home owner.

Family Requirements

Family requirements, as they concern planning and design of the small house, cannot be isolated as a separate quantity, free from technical, social, and economic restraint and limitation. Therefore, any analysis of family requirements must be preceded by an analysis of the conditions of family organization, manner of life, and social and economic influences that are consequential both to technical planning and to execution.

Family organization and manner of living vary geographically, occupationally, and in size. Due to changes in these factors, family requirements as they affect planning and design cannot be considered as static. Consequently, the first "requirement" must be "flexibility of plan" which will provide adequately for changes within the family unit.

This requirement can be met in dealing with the construction of houses in populous areas by consideration of general family requirements. By the study of data relative to size, age, and sex division of families falling within particular income groups in particular areas, the numbers of houses of different sizes and types can be determined. This type of analysis is of further importance in connection with the ownership of houses by families with low income. The financing risk is not determined by economic stability of the occupant as an individual, but rather by the stability of the economic stratum (within the employment area) of which the occupant is a part. Thus, although the house is designed for a specific family, it must conform to the general requirements of local needs and income in order to assure to its owner the replacement (or resale) value. It naturally follows that the small house can no more be planned to meet only the personal tastes and desires of an individual low-income family than can an apartment.

When individual houses are built in less populous areas, the "future addition" may be planned as an integral part of the complete structure. ("Remodelling," on the other hand, has no place in the rational consideration of the small house problem.) The greater ultimate cost involved in building a future addition is more than balanced by the saving in housekeeping labor, maintenance and financing costs, insurance and taxes, etc., during the interval between the erection of the first unit and the future addition—provided, of course, that proper consideration is given to the various factors involved.

This method seems particularly adaptable to the solution of the rural housing problem—the future addition being built by owner labor, which would accomplish the maximum economy in the construction costs of the complete house. The most significant difference in the plan requirements of the urban house and the rural house becomes apparent when due consideration is given to the fact "that the urbanite goes to his work through the front door and the farmer goes to his work through the back door."

Small additions, such as a bedroom, are expensive in relation to their contribution to the total area of usable space. The question of expanding space requirements is, of course, one that concerns the individual family. However, it can be assumed that there is more likelihood of future expansion in the one or two bedroom house, than in the three, four or five bedroom house.

As sleeping space is added, the space per person of other living rooms is proportionately reduced, thus necessitating their expansion if congestion is to be avoided. Dining space may be increased very slightly for this purpose, as it has the highest space use ratio (square foot of floor space per person) of any area in the house.

The living room, on the other hand, though it has a lower space use ratio than the dining area, is of a more flexible nature. It may even be desirable to divide the living room space, particularly when there are older children in the family. The addition of a separate room to be used as a supplementary living room can rationally be made to coincide with the building of additional sleeping space. In the two-story house, one space may be added over the other, thus reducing foundations, roof area, and ground coverage.

In the one-story house—where the living room space has been limited—the living room may be divided to provide a bedroom, closets, and possibly hall space; and a larger living room attained by an addition to the structure.

Porches and attached garages occupy a greater proportion of the exterior wall of the small house than of larger houses. Hence, a separate garage with a gabled porch connecting house and garage is a rational solution. When basement and attic storage space are lacking, a utility room that may be used for general storage and laundry purposes may be combined with the garage which will serve as an excellent drying room—an old fashioned coal hot water heater providing hot water for laundry and heat for drying, thus eliminating long runs of heating and hot water pipes.

Space Requirements and Arrangements

Efficient space arrangement is of obvious importance in attempting to reduce costs without decreasing the quality of construction or the use value of the small house. The requirements of room relations and arrangement in small house planning are more rigid than for larger dwellings.

Space requirements are greatly influenced by local conditions, prejudices, and manner of living. Consequently, in dealing with such variables it is necessary to restrict the establishment of general plan requisites or the physical elements involved.

Because of reduced dimensions and concentrated use of space, circulation becomes the determining factor in the efficient functioning of the small house. Reduction of connecting halls should be accomplished to as great extent as will still allow for their function as a connecting unit, avoiding undesirable circulation and affording direct access between rooms of private nature and those common to the household. Wall space may be preserved in living rooms by the use of a central circulation nucleus, the central hall, for passage between rooms.

Multiple-use areas, such as living-dining room, kitchen-dining room, and guest accommodations combined with the living room couch, are becoming common practice in the effort to attain concentrated space use. Such methods are of value particularly in the solution of the basic problem of small house planning, that of attaining room dimensions that are adequate in relation to architectural elements and household accessories (doors, stairs, furniture, etc.) that must conform to human dimensions.

The proportion of space that such plan factors occupy varies inversely in relation to room dimensions. Consequently small house plan solution is not merely a matter of uniform space reduction (or shrinking) of the larger dwelling to fit the cost limitations of the small house.

The requirements of room relation and arrangement in small house planning are more rigid than for larger dwellings.

Simplicity of structural form should be preserved if construction costs are to be controlled. Foundations, bearing walls, partitions, and roofs must be designed in strict conformity to the construction methods and materials employed.

Stock dimensions of lumber should be adhered to as far as is possible without disturbing the efficiency of plan and the simplicity of structural form. Plumbing and heating should be planned for maximum economy of space, labor, and materials. Cross ventilation is not difficult to attain as nearly every room in the small house—because it is small—has two exposures.

Such a review of the peculiar demands of small house design brings out an important point. In view of the extensive study required in small house planning and the small remuneration, imposed by economic limitations, it seems scarcely possible for the architect to base his practice on small house commissions—except by a definite departure from customary methods of rendering architectural service. Such adjustment demands not only change in technical methods, but a change in concept that will permit closer cooperation with the other elements of the building industry.

Materials

Present conditions make it difficult to analyze, to any conclusive degree, the merits of any but long-established materials and methods of fabrication. Information concerning newer materials, used in combination, and under varying conditions, humidity, temperature, etc., is very meager.

Though exhaustive laboratory tests were to prove the dependability and superior qualities of a new material, its wide use in small house construction would depend upon the slow process of adaptation by technicians and material dealers. Inasmuch as the technician is at present responsible for only a limited percentage of small house construction, the general use of a new material depends very largely on its commercial effect upon the local material dealers.

Further limitations that retard the adoption of new materials are imposed by the attitudes and technical ability of the ordinary building mechanic. Established practices of builders, mechanics, and building codes often place strong barriers in the path of the general use of new materials.[4]

Better Organization

While the use of new materials which give better service should be encouraged, in view of these difficulties it does not seem practicable that an attempt to produce better small houses at a lower cost should await solutions primarily based upon the use of new materials and new methods of construction. Equally satisfactory results may be obtained by better methods of utilizing those materials to which the building industry is accustomed.

The adoption of new materials and methods of construction may, fortunately, be a slow process. The cold, thin formality that is the dominant note in so many of our modern dwellings is definitely at variance with the manner of living to which the average citizen is accustomed. Nor is such barren severity a necessary expression of structural or operative functionalism.

New materials less devoid of texture and color are available in great variety and abundance. The use of these less impersonal materials would neither destroy the feeling of functional simplicity as expressed in the structural form, nor adversely affect the use of modern technics of construction.

Better planning and organized cooperative effort on the part of the planning element of the residential building industry would have a far-reaching effect on production and distribution costs of materials. The haphazard demand for unnecessary variation in architectural detail, dimensions, and structural elements results either in excessive stocks or in special orders, which greatly increases manufacturing costs. The risk to which the local material dealer is subject in attempting to carry a complete and varied material list including stock windows, doors, siding, mouldings, etc. results in considerable cost increases which are detrimental to all and of benefit to none.

Such practices have no place in any small house program for low income groups. The only alternative is coordination of the planning charts of the industry to simplify materials demands.

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[4] Many of the difficulties that must be overcome if we are to solve the problem of producing adequate shelter for low income groups are deeply rooted in the basic composition of the construction industry, and are perpetuated by city and state building ordinances with which the building industry must comply. The complexity of the difficulties involved in attaining better organization and more efficient methods of production and finance is admirably set forth in an anonymous article, "Facing the Facts on Housing," *Harpers Magazine* March 1937, p. 419. See also the discussion in section on building regulations.

The selection of proper materials to meet the technical, social, and economic requirements of small house construction is indeed a task for the highly trained specialists.

It is obvious from this analysis that reorganization of the building industry on a basis which will coordinate these elements so as to achieve a more satisfactory result must be a slow process, and that very complete reorganization will have to be made before the needs of those in low income brackets can be dealt with directly by any new residential construction program.

However, as the process takes place, starting with the improvement of coordination of the existing elements of the residential building industry, the volume of effective demand will increase in proportion to the volume of income of the new economic levels thus reached.

Inasmuch as the volume of mass income varies rapidly in inverse proportion to individual income level, it is reasonable to believe that a lower margin of profit would be accompanied by an expanding volume of profit.

Beginnings are being made at many points within the residential building industry, aided by the active cooperation of local and federal governments. New methods of building, new materials, new designs, new organizations are appearing, many of which are distinct improvements.

Maintenance

Though it may be trite to call attention to the fact that maintenance is a basic economic factor in low-cost housing, its importance is frequently neglected. Certainly, the possibility of error in relegating maintenance responsibility must be admitted in analyzing prevailing practice.

Some stress has been placed upon the necessity of good design (structural and aesthetic) and such supervision as would assure both the lender and owner of satisfactory execution. From a technical viewpoint, the proper maintenance of the structure is assumed. No attempt to create a house that would endure without maintenance for a protracted period has been successful, nor is it likely that such a possibility will occupy the serious considerations of the building industry within a calculable period of its operation.

Certainly, the maintenance of a house is of the greatest economic significance to those whose investment is dependent upon its durability and preservation. Despite this fact, the current practice of lending institutions allows the responsibility of maintenance to rest too heavily in the hands of the owner. It may be argued that the owner should be made responsible for the maintenance of the house he purchases, on the grounds that his interest in the preservation of its value is permanent, whereas that of the lending institution ceases upon the termination of the loan. Such a premise fails to deal with the limitations of the layman's knowledge of maintenance requirements or of his ability to supervise properly maintenance operations, and the fact that neglect (regardless of responsibility) can result in serious disintegration of the property in a fraction of the loan period.

If the low income purchaser cannot pay for such disintegration without jeopardizing other basic demands upon his income, it is not reasonable to make him responsible for the maintenance of the property.

Experience in Planning Small Houses

> In the modern skyscraper * * * the coordination of all factors—design, engineering, materials, form—has been brought to such perfection that structures of this sort are the outstanding contribution of this country to architecture. * * * It seems to dominate not only architecture but the architect as well. Attracted by the unit mass of the office-building he has overlooked the small home—its dominantly social motif and its bewildering conglomeration. * * *
>
> That the dwelling-house, serving a basic and indispensable need of mankind, is worthy of the best effort of the architect should be self-evident.[5]

While private builders and architects have studied the small house for many years, only recently has the Federal government given its attention to the problems of planning and design. As the result of the various influences which have made housing a national problem joint efforts between the government and private agencies have been focused on these problems.

This section deals with some of the experience of governmental agencies in their efforts to advance the art of planning and design in the small home. With the one exception of those interested in experimenting with prefabrication (which is treated below), the general effort to effect economy and efficiency has been through intelligent use of materials and rational designs; this is necessarily the first step towards reducing costs.

Federal Housing Administration

An essential part of the insured mortgage system which has been developed under the National Housing Act has been the establishment of physical standards for properties which are offered as mortgage security. Upon what basis have these standards been formulated and applied?

In approaching the task of establishing property standards which would advance these purposes, the Federal Housing Administration recognized that housing standards are relative and that they have little meaning except as they are related to particular problems. They serve merely as measurements to determine the adequacy of housing in relation to its purposes. Minimum housing standards were conceived as the lowest standards which would satisfactorily accomplish those intended purposes.

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[5] Bemis, Albert F. *The Evolving House.* Technology Press, Massachusetts Institute of Technology, Cambridge, Mass., 3 volumes, I, 1933; II, 1934; III, 1936.

Consequently, before setting up these minimum standards, it was necessary to analyze the purposes or essential functions of the housing which falls within the scope of the National Housing Act, and to extend this analysis to such conditioning factors as climate, location with particular reference to urban, suburban, or rural conditions; health and sanitation requirements; safety; income levels; custom; real-estate practice; and costs.

The standards which the Federal Housing Administration finally formulated necessarily had to be adapted to the existing fabric of the construction industry. If the administration were to encourage home building, it could not place its standards of construction nor its requirements for improved housing conditions at such high levels that costs would be raised unreasonably. Conversely, it could not place them at levels which would permit inadequate security for a long-term mortgage or which would impair public confidence in the soundness of the dwellings offered for purchase under the insured mortgage plan.

It chose, therefore, a level for its minimum physical standards which was generally recognized as being obtainable and as conforming with good practice. This level was not necessarily the most desirable one nor was it intended to be. However, it was intended to establish standards higher than those which had been generally achieved. It aimed to include only the fundamentals and to ignore what are generally termed the amenities.

Therefore, it stressed those factors which would assure substantial and durable structures, adequate light, ventilation, and sanitation, privacy in living, convenience and efficiency in arrangements, and protection against overcrowding and the disintegration of neighborhoods.

It was not considered essential to require the latest developments in convenience, equipment, fireproof construction, or garages. While these might be desirable, they were not considered minimum requirements, lacking which a property would be ineligible for mortgage insurance. Where, however, they are built into the property in such a manner as to represent real value, credit is given under the Administration's risk-rating system and their presence is recognized in the appraised values.

That these minimum requirements deal with fundamentals, rather than the amenities, was shown by the Administration's design of a house which would just comply with the minimum standards. This was house A, illustrated in Federal Housing Administration Technical Bulletin No. 4, *Principles of Planning Small Houses*. It was estimated that this house could have been built of conventional materials in the spring of 1937 in most communities at a cost of from $1,200 to $1,500, not including the cost of the lot, utilities, landscaping, drives, walks, basement, sales, and financing. While, to the Administration's knowledge, no houses actually have been built after this design, other low-rent house designs illustrated in the same bulletin have been followed in the construction of a number of homes whose costs have been within the Administration's estimates.

Tennessee Valley Authority

Of the several housing developments undertaken by Federal agencies, those of the Tennessee Valley Authority, at Norris, Tenn., have probably been watched as closely as any other for their contribution to the technique of small house design. It was assumed that construction should be of an enduring type to require a minimum of upkeep. The experiments were chiefly concerned with the economic effects of variations of size and form. Such experiments as were made with new materials and methods of construction were relatively of secondary importance. The variations in cost that resulted from the use of different materials were, surprisingly enough, of such negligible proportions that they can be ignored for all practical purposes. Economy was sought through the maximum use of space rather than by means of sleight of hand methods of construction.

Farm Security Administration

As an incident to its program of the rehabilitation of low-income farm families, the Farm Security administration has engaged in the construction of homes in a number of rural communities. Profiting by the experience of several years the Administration has modified and improved its building program in numerous ways. By establishing cost limits emphasis was focused on the highest possible quality within those limits. In 1937 the figure for rural homes was limited to between $1,200 and $2,100, and the cost of the entire farm unit, including outbuildings, to between $2,900 and $4,200. The variations in cost are established primarily to compensate for differences in construction necessitated by climatic factors and the requirements of different types of farming.

To keep within the cost limits design has been simplified and integrated with construction, building techniques on the site have been organized, and a degree of prefabrication introduced. Standard materials are used, and every gable, beam, and rafter not absolutely necessary has been eliminated. Nor are purely "decorative" features included in these simple structures. As most of the buildings are of frame construction, it has been possible to pre-cut the lumber for a large number of houses at a central point. Pre-cutting in this manner requires only one-sixth the time required for hand-sawing on the site. Similarly, window and door frames are prefabricated. These methods enable speedy assembly at the site by relatively unskilled labor under proper direction. During 1937 some 3,370 of the 10,000 projected units were completed.

The rural construction by the Farm Security Administration is not to be confused with its well-publicized suburban projects. With the exception of Greendale, Wis., the suburban projects have involved multi-family construction. About one-half of the dwelling units at Greendale are single houses. In this community, careful study of the relation of house to site has resulted in a contribution to the problem of planning a small-house neighborhood compactly and economically without sacrificing safety, privacy, and the amenities of living.

Home Owners' Loan Corporation

The experience of the Corporation in refinancing over one million small home properties vividly disclosed deficiencies in planning and construction practice in the small house field. These deficiencies could have been corrected for the most part through insistence on the part of the lenders on efficient plans, intelligent use of materials, qualified contractors, and supervision of construction.

In the administration of its reconditioning work the Home Owners' Loan Corporation has made a forward step in the organizing of the construction industry with regard to repairing, remodeling, and modernizing. One of its principal contributions to simplified practices was the development of its master specifications now used in all sections of the country, which, in connection with preparation of papers for bidding purposes, has advanced standardization considerably to the benefit of all parties concerned. The experience of the Home Owners' Loan Corporation in the handling of over half a million building contracts effectively and economically through standardization of forms and procedure, suggests that similar patterns that might well be considered by those elements in the construction industry dealing with small home construction.

Conclusion

The Federal Government, in addition to requiring complete plans and specifications for all projects in which it is interested, supervises the construction with meticulous care. Commercial and industrial interests do likewise in their building programs. It is the exception rather than the rule when a home owner in the higher price class does not definitely concern himself regarding the fitness of the plan and value obtained in construction. Only in the small house field is found serious apathy and often positive avoidance on the part of the home owner and lender of the principles of construction practice cited above. If a major building boom should eventuate in the small house field without appropriate technical advice and supervision, there can be expected a repetition of the deficiencies in construction revealed by the experience of the Home Owners' Loan Corporation, only greatly intensified.

There has been a decided interest in the past two decades in encouraging closer cooperation between the many elements which make up the construction industry. These efforts have found expression in the activities of producers' councils, construction leagues, chambers of commerce, building congresses, and others more local and less representative, all of which are dedicated to a better understanding of the many problems of the industry. Some considerable accomplishment has been effected, but there is still sufficient reason for continuance and expansion of such agencies. Group thinking has not been sufficiently objective, and further, little of that thinking has been concerned with the small house problem. This neglect of the small house by these groups is natural. The small single family dwelling unit has in the past furnished little to stir the imagination of those builders of more pretentious homes who usually make up the membership of the organized groups just mentioned.

What nationally-organized elements in the housing field might best assume the leadership in correcting some of the varied problems having to do with small house construction? The architectural profession is one, since by training and professional background the architect is technically equipped, and free from influences which might develop from prejudiced vested interests. Home financing agencies might appropriately be another element, since they are for the most part trustees of the public's funds, and have a major investment interest in the financing of the projects.

These local factors cooperating under intelligent national leadership possess tremendous powers to correct abuses. The technicians can advance the art of planning and construction; the lenders, through their control of funds, can assure proper execution of the technical advance. By this cooperation a rallying point is established for the other important elements of the industry. Heretofore, the necessary focal point has been absent; and when at the end of innumerable industrial conferences resolutions have been passed to the effect that "something must be done," little has been done, because there has not been definitely established an agency or device to which the unorganized group could look for leadership.

The Federal Housing Administration's efforts in this direction have been referred to above.

The Federal Home Loan Bank Board, in September 1936, approved a program known as the Federal Home Building Service Plan, which is a device to encourage local cooperation between the lender and qualified technicians to furnish an advisory and supervisory service to prospective home builders in the small house field. This program has the support of the leaders in the architectural profession and gained considerable momentum in its first 2 years of operation. The time is favorable for the expansion on a national basis of such instruments of service as have been promoted by the Federal Housing Administration and the Federal Loan Bank Board.

Prefabrication

For many years, the idea of designing a completely prefabricated dwelling unit has occupied the attention of both the amateur and the professional designer. Once bitten by the idea, there seems to be no escape from it. The idea is alluring and is a challenge to man's ingenuity and inventive powers. Because of far-reaching technological advance in so many fields, it would be unwise to conclude that a practical solution will not be developed.

There is sufficient evidence available at this time to make it apparent that the magic formula has not yet been found; moreover, in the past few years much unfortunate publicity connected with immature prefabrication developments has unquestionably delayed and discouraged the construction of many dwellings which might have been built under traditional methods. This publicity has been to the disadvantage of both processes of construction.

The problem is worthy of the best technical minds of the country; it is a problem also that extends beyond purely objective technological processes. The following outline lists the numerous reasons why current efforts to produce a prefabricated dwelling unit have not met with marked success.

Outline of Reasons for Failures in Prefabrication [6]

I. Failures inherent in the broad approach:
  1. Building only a wall, or floor, and so on.
  2. Designs fundamentally impossible to transfer to a factory.
  3. Superficial suggestions based on wishful thinking or desire for publicity.
  4. Prime purpose not achievement of a prefabricated house but obtaining a larger market for specific materials or equipment.
  5. Prefabricator not a businessman at all, but only a designer, doing no manufacturing himself.

II. Failure through insufficiently low cost.
  1. In the factory.
    A. Not enough purchasing power, involving.
      a. No low-cost commodities.
      b. No mass production.
      c. No control of production at all.
    B. Inadequate or no engineering study from the factory point of view; designs not suitable to high-speed production.
    C. Use of fundamentally costly materials or processes.
  2. In the field.
    A. Too little of the building a product of the manufacturer.
    B. Too much field work.
    C. Too great precision of erection required.
    D. Insufficient precision of erection afforded.
    E. No scheduled manner of erection.
    F. Too much equipment required for erection.
    G. Insufficient or no provision for easy installation of wiring and piping.
  3. Transport.
    A. Failure to use materials that can be delivered to the factory at low freight charges.
    B. Finished units too large to be shipped and handled economically.
  4. Excessive marketing costs due to insufficient capital or inexperience.

III. Failure because product nonmarketable.
  1. Architectural failure.
    A. Poor plans.
      a. Plans dictated by apartment thinking.
      b. Plans dictated by ultramodern logic not yet acceptable.
      c. Lack of flexibility of normal family patterns.
      d. Lack of studied equipment.
    B. Poor arrangement of equipment.
      a. Under-equipped.
      b. Inadequate provision for installation of piping and wiring.
      c. Over-equipped.
    C. No fundamental study of the house as a machine.
    D. However attractive by pure aesthetics, not keyed to popular taste.
  2. Structural failure.
    A. Dubious use of materials.
    B. Dubious use of flat roof.
    C. Dubious flimsiness (i. e. "though the thing may really be strong enough, if people can push against it or rap on it or do anything that makes it behave differently from what they are accustomed to, they are worried about it."
  3. Financing failure.
    A. Due to the theses of prefabrication, inability to obtain enough percentage loan from permanent financing institutions requiring too much down payment.
    B. No corporate possibility of bridging the financing gap.
      a. Insufficient financial power.
      b. Inability to do any marketing until price nearer the final price.
      c. Efforts to apply the fallacious renting thesis.
  4. Premature ballyhoo.

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[6] This outline was read and elaborated before the Technology Housing Conference in Boston, June 7, 1937, by John Ely Burchard, architect in charge of housing research for Bemis Industries, Boston. In collaboration with the late Albert Farwell Bemis, Mr. Burchard wrote the three volume work *The Evolving House*, Volume I, *A History of the Home;* Volume II, *The Economics of Shelter*, Volume III, *Rational Design*.

IV. Failure because of insufficient quality (such as unscientific or unsound use of existing materials—rare).
  1. Wood.
    A. Dry wood next moist materials.
    B. Green unseasoned wood.
  2. Steel.
    A. So used as to cause condensation.
  3. Miscellaneous.
    A. Insufficient heat insulation.
    B. Cold floors.
    C. Use of unbalanced units.

While many minds have given thought to the problems involved, attention is called to the work of R. Buckminster Fuller as illustrating two methods of approach: first, the consideration of the complete house and second, the consideration of parts of the house. Mr. Fuller's *Dymaxion House* (1928) describes his approach. It is of interest to record Mr. Fuller's subsequent observations (1934) concerning his design: "The Dymaxion House is still as it has been for years—a theory only. Despite pragmatic criticism it has conscientiously been kept so. While theoretical it is immediately improvable by every scientific advance. Its monthly improvements and inclusions are vaster than the yearly refinements and inclusions in the automotive world, as it has never been burdened with overhead nor with heavy industrial-investment earning requirement."

This last statement has considerable significance to anyone interested in the development of a prefabricated dwelling unit. Perhaps a more immediately useful contribution in fundamental thinking by Mr. Fuller is found in his design and construction of what he calls an integrated bathroom unit. This unit is illustrative of one of Mr. Fuller's earlier convictions: that the factor of weight in relation to construction processes is of serious purport and too little attention has been given to this element in building construction.

The complete bathroom unit which includes floor, walls, ceiling and fixtures is designed in two sections and installation can easily be accomplished by two men. A total weight of 250 pounds for the complete bathroom compares with an average weight of over 1,000 pounds for a standard tiled bathroom of similar size and with luxury-size fixtures. Space is another consideration directed toward economy, as the unit occupies an area 5 by 5 feet.[7]

In carrying out research of this type, Mr. Fuller is not alone. The work of many others will doubtless add equally valuable results. The solution of such technical problems today is usually joint rather than individual. The probabilities in the field no one can predict. Some students are convinced that savings in the neighborhood of 15 percent of the cost of the structure are all that can be anticipated—even with complete success. Such savings are equally possible within the traditional framework of building. Nevertheless, inventions have a way of proving all predictions to be wrong.

Conclusion

House building has long been regarded as the easy job of the building trade, requiring neither trained skill in planning and design, nor science in erection. While, in the past, science and skill have been devoted in an ever increasing measure to the betterment of office buildings, highways, hotels, bridges, and other large structural projects, no such attention has been paid dwelling construction. The popular belief that stock plans that need "only a little shifting around" plus a little knowledge of the fabrication of materials is sufficient to insure a satisfactory home accounts for many disappointed and disgruntled home owners.

If all the building industry hopes to do is to provide enough roofs to take care of the population increase, its vision is pitiful, particularly in view of the fact that the rate of population increase is declining steadily. If, however, it can realize that through cooperation in the solution of its technical problems it can raise the standard of American housing, and keep on raising it, then the industry can be established and not go bobbing along from boom to depression, selling contractors' liens at 50 cents on the dollar and trying to recoup from the next customer. It is obvious that in order to deal with the problem the individuals who supply the various ingredients in home building must be coordinated so that the problem may be attacked on all fronts simultaneously. When the problem becomes one of replacement rather than expansion, the salvation of the building industry will lie in improved replacement rather than new volume.

With long term loans and cheap money, lenders must take steps to assure themselves that homes will last longer than the loans. Moreover, under present day conditions the individual is less attached to the soil or to a particular community than formerly. The borrower may go away, but the home remains to be used by others. Therefore, increasing importance attaches to the home itself as the physical security for the loan.

The tendency to pass lightly over the real technical needs of the small house has caused such home building to gravitate to agencies not properly equipped or staffed to render the needed technical service. The architectural activities of those not qualified by education, training or experience to deal successfully with planning, design, and construction have resulted in eyesore after eyesore. Frequently entire neighborhoods of architectural "hair-raisers" grace the landscape. In some cases, the material dealer, attempting to act as architectural adviser and designer, is the one at fault. In others, it is the contractor.

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[7] For photographs, drawings, and description of this unit see the January 1937 issue of *The Architectural Record*.

Little can be done to eliminate these architectural fantasies which threaten land values and the demand for new homes unless some means is found to infiltrate competent technical advice and assistance concerning plan, design, and building into the small house field. The judicious use of well selected low-cost stock designs is quite reasonable. In many cases, such designs will suffice to meet average needs, provided that the home builder can be guided and advised in his selection by qualified technicians who will also provide the degree of building supervision necessary to insure good results.

Progress will come when all home building participants find a common ground upon which they can unite to offer the home builder a positive means of getting better design, better adapted to the site and the neighborhood, as well as the right kind of supervision. Only through such measures can the owner be assured of dollar for dollar value, the lender of a good loan, and the industry of a home that will encourage, rather than discourage, families contemplating home building.

The most valid criticism that can be leveled at the building industry is that each group within the industry is preoccupied with its own affairs and fails to be guided sufficiently by the equally important requirements of the other collaborators in the building project. Also, those who speak for the various industry groups are prone to view with alarm any movement aimed at the betterment of home construction, since such efforts must, of necessity, be based upon considerations other than those which appear of primary importance to the particular group affected. Seldom has there been a greater need for an appreciation of the other fellow's position and a willingness to drop petty differences in evolving some means of improving the serviceability, quality, and appearance of the Nation's houses.

It is perhaps only natural that those who have come to assume certain technical functions in home building should resist a more proper alignment of the technician in relation to other construction factors. However, it is becoming more and more apparent that, once the dealer or the contractor understands the harm being done him by jig-saw design, the use of improper materials and irresponsible construction, he will join hands with other responsible factors in any well-defined movement to insure better homes.

An incredible volume of small-home construction is built in rural, urban, and suburban areas in single units, and a housing program based on housing needs in these particular areas does not call for large-scale construction methods. In seeking economies in construction of the small home, the construction system as it exists today must be accepted but step by step changes necessary towards a final objective must be taken.

In the construction of a building it is a generally accepted fact that plans are desirable preliminary to commencing construction operations. In the small house field the country does not suffer from a lack of small house plans issuing from innumerable sources; and except in general room arrangement the prospective home builder has a wide selection of styles, materials, and equipment, both unique and bewildering in their variety. An examination of these plan services for the most part discloses inefficient planning, excessive costs due to structural lines, unwise use of materials and combinations of materials, and little regard for local construction methods.

The Federal Government in its different housing agencies has studied with care the plan and design of the small home. But the work to be done remains of large volume. These studies should be continued with a view to correlating the usable information and making it available to those elements in the industry best equipped to utilize it intelligently in their respective communities. To serve the small home builder adequately it is both possible and practical to develop a series of base plans (dimensions and arrangement of rooms and equipment) which will meet desirable standards for given sizes of families. This series might not exceed 30 plan types covering 4-, 5-, and 6-room houses, 1 and 2 stories, in which different elements susceptible to standardization may be fixed or recommended, such as kitchen layouts and equipment, bathroom sizes and equipment, window and door sizes and design, trim, stair design and other mill work. These base plans and recommendations could be then distributed to competent architects, in areas where local conditions have particular influence on design, for final development. There are many benefits, direct and indirect, to be gained through a program of this kind which can only be effected by a Federal agency in cooperation with the technical profession. Mass production of many of the above-enumerated items can be made possible; speed in construction can be accomplished through greater standardization. Design suited to local conditions should result in lower maintenance costs, and so on. An important result would be the elimination of the wasteful, ill-advised existent stock plan services. Such a program of better integration would not necessarily produce undesirable monotony, but would result in the development of local character in small home building. That community which is always found so attractive in the older New England towns, with its unity in scale and design pattern, is a form of local standardization which, although resultant from different factors than those of today, still points the way to indigenous building.

Continuing concentration on the small house problem by competent technicians is essential to the development of such a program.

IV. BUILDING MATERIALS AND THE COST OF HOUSING

By Theodore J. Kreps[1]

Introduction and Summary

Building materials are about twice as significant in the on-site cost of building as labor costs. Price inflexibility, restriction of production, and wastefulness of distribution characterize the building materials industries. These are important factors retarding home building. Their removal depends not only upon increased efficiency in industrial organization but also upon a reduction in the relative prices of some of them by elimination of interference with freedom of competition.

The importance of building materials in the housing problem is frequently underestimated. Building materials costs usually range from somewhere near equal to double the on-site wages bill. Thus, a change in the price of building materials may have as much as twice the effect of an equal percentage change in wage rates. Prices and practices in the building materials industries, therefore, deserve careful and continuous examination.

During 1936 and 1937 building materials caused more than twice the amount of increase in costs of residential construction that could be attributed to increases in wages. Some important building materials were from 20 to 30 percent higher in price than they were on the average throughout the building boom of the "twenties," notably Douglas fir, yellow pine and white pine lumber, plaster, various steel products and certain types of brick. In 1937 increases in the prices of important building materials may well have helped to stifle incipient recovery of residential building. This fact, together with consistent inflexibility of price movements, suggests that certain producer organizations may recently have perfected the technique of "closely adjusting production to consumption" to the point where the long-sought-for "stabilization" of prices was on the verge of realization. At any rate, the more important building materials continue to be restrictedly produced, inefficiently and even wastefully distributed, and assembled and utilized without benefit of the economies either of large-scale residential building operations or of vertical combinations integrating homebuilding from sawmill and brick factory to homeowner and investor.

Building Materials Versus Labor Costs

The first step toward assessing the place of building materials in the housing picture is to specify the type of house used as standard of reference. Attention will be focused upon the single detached one-family dwelling of wood or brick. That is the type in which 22,833,110 families out of a total of 29,904,663 families lived in 1930. In that year 16,164,429 out of a total of 18,536,295 nonfarm dwellings were one-family structures. A glance at figure 30 shows that they comprise three-fifths to three-fourths of the nonfarm dwelling units built since 1929. Judging from the experience of Great Britain and other countries that have made headway toward providing low-rental housing, they constitute the kind of structure promising the largest measure of success.

The most important type of construction is, of course, the wooden frame structure. In 1923–25, for example, a survey by the United States Department of Commerce[2] showed that about 80 percent of dwellings in communities of over 2,500 population, and fully 90 percent of those in smaller communities, were constructed of wood. Another survey by the Fidelity-Phoenix Fire Insurance Co. in 1932 covering 40 cities in the United States put the figure somewhat lower—at 68 percent.

There is, to be sure, wide variation in this regard between individual cities. In Los Angeles virtually all the single and two-family houses are of frame construction. In Detroit, according to an estimate of the Department of Buildings and Safety Engineering, from 65 to 75 percent of the dwellings are of frame construction. In Philadelphia in 1928, on the other hand, of 415,045 dwellings only 9,248, or less than 2.3 percent, were built of wood.[3] The general average none the less remains high, probably somewhat more than two-thirds. Consequently, by focusing attention upon single-family dwellings of wooden frame construction a large portion of housing is brought within consideration.

Even for the single-family house the ratio of materials expense to labor expense varies with the style of architecture, the size of the community, the composite of materials, the geographic area, and the method of building and financing. The simpler the plan of the house, the smaller the size of the community, the fewer the gadgets, the further south and West, usually the lower the labor expense. The ratios vary considerably as between houses built to the specifications of the individual owner and those built for a market by a large-scale real estate operator or speculative builder. They also differ markedly as between projects financed and built by individual contractors and by Government agencies. Private contractors have greater leeway in the use of their bargaining strength to get concessions on materials or labor. Government agencies on the other hand must meet certain trade union standards and more often encounter uniform bids for material. These, among many other factors, cause a considerable variation in the ratios.

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[1] Dr. Theodore Kreps is Associate Professor of Business Economics, Graduate School of Business, Stanford University. He was formerly Chief of the Statistical Section, Research and Planning Division, National Recovery Administration, and Chairman of the Coordinating Committee of the Central Statistical Board and the Works Progress Administration.

[2] *Domestic Market Possibilities for Sales of Paints and Varnishes* (Washington, 1925), pp. 18, 20.

[3] Newman, Bernard J., "What the Rest of the Country Can Learn from Philadelphia," in *Housing Problems in America* (National Housing Association, New York, 1929), vol. X, p. 40.

Nevertheless, during the last 10 years building materials have ordinarily comprised about two-thirds of the cost of the structure, and labor at the site slightly over one-third. In the *Census of Business* for 1935, general building contractors reported only 33.7 percent [4] of the cost of total work performed as consisting of payroll. The remainder consisted of materials, overhead, and profits.

There is, of course, considerable variation within the same city and between various cities. In 1931–32, for example, the Bureau of Labor Statistics obtained the results shown in table I. Note that materials ratios are relatively high in the South but low in New England and New York, varying from percentages as high as 74 percent in Dallas, Tex., to figures as low as 56.9 percent in Boston, Mass. These variations in the ratios of cost of materials to total cost are, of course, due in large degree to differences in labor costs. The variation between individual residences in the same city is also striking, usually being about 10 points or roughly a sixth.

TABLE I.—*Percentage distribution of cost of construction between materials and labor for residential construction in cities, 1931–32* [1]

	Averages by cities		Range in individual buildings			
			Material		Labor	
	Material	Labor	High	Low	High	Low
Atlanta, Ga	70.1	29.9	73.8	63.5	36.5	26.2
Boston, Mass	56.9	43.1	60.9	43.8	56.2	39.1
Chicago, Ill	65.1	34.9	65.9	60.3	39.7	34.1
Dallas, Tex	74.0	26.0	80.2	68.8	31.2	19.8
Duluth, Minn	66.3	33.7	70.1	62.3	37.7	29.9
Indianapolis, Ind	59.7	40.3	72.3	56.3	43.7	27.7
Little Rock, Ark	67.7	32.3	71.2	62.3	37.7	28.8
New Orleans, La	69.4	30.6	73.1	60.8	39.2	26.9
New York, N. Y	59.6	40.4	67.8	57.2	42.8	32.2
Roanoke, Va	64.1	35.9	69.3	59.6	40.4	30.7
Saginaw, Mich	66.5	33.5	67.8	54.1	45.9	32.2
St. Louis, Mo	63.0	37.0	70.4	55.7	44.3	29.6
Salt Lake City, Utah	65.6	34.4	67.9	61.8	38.2	32.1
Seattle, Wash	57.5	42.5	68.5	55.5	44.5	31.5
Trenton, N. J	59.0	41.0	62.7	52.4	47.6	37.3
Weighted average, 15 cities	62.7	37.3	--------	--------	--------	--------

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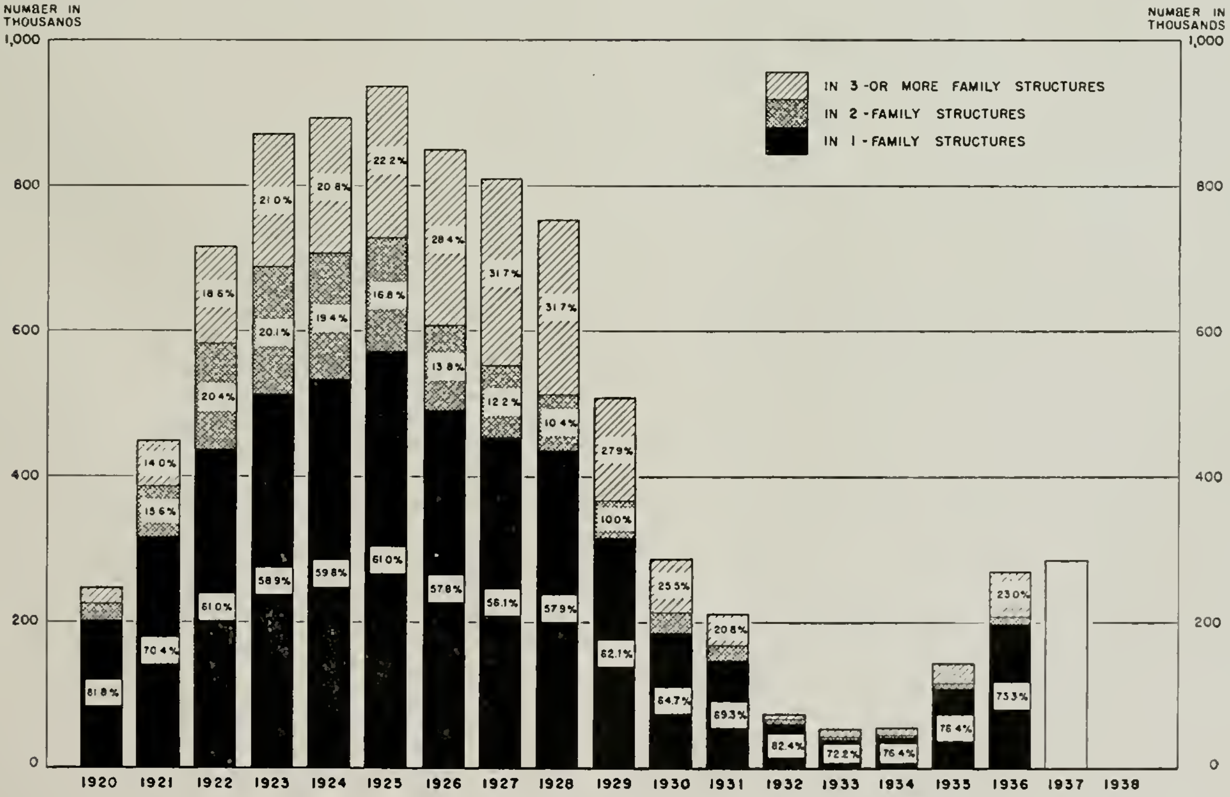
[4] *Census of Business, Construction Industry: 1935*, vol. 1, p. 45, table 2.

[1] *Monthly Labor Review*, October 1932, pp. 764–765.



Source: Federal Housing Administration, Division of Economics and Statistics, Chart No. C 5, 553 A. December 30, 1936.

FIGURE 30.—Estimated number of nonfarm dwelling units by types of structure, 1920–37.

No accurate figures exist as to the number of dwelling units built annually in the United States. These estimates are based on census data and on building permit data reported by the Bureau of Labor Statistics. The National Bureau of Economic Research estimates were used for 1920–1935; estimates for 1936 to date were made by the Federal Housing Administration.

Even when identical quantities of materials and labor are compared, a considerable amount of variation occurs not only between cities but between different periods of time in the same city. The Federal Home Loan Bank Board has been collecting figures on identical quantities of materials and labor requisite to produce a standard wood-frame six-room house. These figures are obtained in 90 cities and grouped according to the areas established for the operations of the Board.

In table II data are presented for 26 of the more important of these cities. The rise and fall in costs is shown for months one year apart. The midsummer of 1937, being the period when building activity began to decline, is compared with the midsummer of 1936. Notice in the column showing percent of cost due to materials that the figures group themselves in the interval between 65 and 70 percent, though ranging from roughly 57 percent in Chicago to 76 percent in Wichita, Kans.

TABLE II.—*Cost of labor and materials for construction of the same standard house in 26 specified cities, 1936 and 1937* [1]

TABLE II.—*Cost of labor and materials for construction of the same standard house in 26 specified cities, 1936 and 1937* [1]—Continued

Federal Home Loan Bank Board districts and cities	Month and year	Total	Labor	Percent	Materials	Percent	Ratio of percent increase in materials to percent increase in combined costs [2]
District 1							
Boston, Mass	June 1936	$5,039.91	$2,102.75	41.7	$2,937.16	58.3	
	June 1937	5,665.54	2,314.99	40.9	3,350.55	59.1	
Increase		625.63	212.24		413.39		1.14
Providence, R. I	June 1936	4,812.38	1,713.60	35.6	3,098.78	64.4	
	June 1937	5,201.55	1,701.60	32.7	3,499.95	67.3	
Increase		389.17	−12.00		401.17		1.59
District 2							
Newark, N. J	July 1936	5,055.89	2,167.10	42.9	2,888.79	57.1	
	July 1937	5,657.76	2,238.10	39.6	3,419.66	60.4	
Increase		601.87	71.0		530.87		1.55
Albany, N. Y	July 1936	4,677.29	1,655.51	35.4	3,021.78	64.6	
	July 1937	5,294.21	1,919.59	36.3	3,374.62	63.7	
Increase		616.92	264.08		352.84		.89
District 3							
Philadelphia, Pa	August 1936	4,321.48	1,425.53	33.0	2,895.95	67.0	
	August 1937	5,209.51	1,843.53	35.4	3,365.98	64.6	
Increase		888.03	418.00		470.03		.79
Pittsburgh, Pa	August 1936	4,769.71	1,453.28	30.5	3,316.43	69.5	
	August 1937	5,944.45	1,986.82	33.4	3,957.63	66.6	
Increase		1,174.74	533.54		641.20		.78
District 4							
Birmingham, Ala	June 1936	4,398.74	1,383.12	31.4	3,015.62	68.6	
	June 1937	5,326.62	1,789.14	33.6	3,537.48	66.4	
Increase		927.88	406.02		521.86		.82
Tampa, Fla	June 1936	4,709.09	1,353.95	28.8	3,355.14	71.2	
	June 1937	5,025.39	1,373.83	27.3	3,651.56	72.7	
Increase		316.30	19.88		296.42		1.31
Richmond, Va	June 1936	4,413.30	1,329.30	30.1	3,084.00	69.9	
	June 1937	4,608.65	1,376.70	29.9	3,231.95	70.1	
Increase		195.35	47.40		147.95		1.09
District 5							
Cleveland, Ohio	August 1936	5,386.98	2,154.73	40.0	3,232.25	60.0	
	August 1937	6,105.56	2,329.48	38.2	3,776.08	61.8	
Increase		718.58	174.75		543.83		1.26
Nashville, Tenn	August 1936	4,472.10	1,400.42	31.3	3,071.68	68.7	
	August 1937	4,836.00	1,397.18	28.9	3,438.82	71.1	
Increase		363.90	−3.24		367.14		1.47
District 6							
Indianapolis, Ind	July 1936	5,084.02	1,741.50	34.3	3,342.52	65.7	
	July 1937	5,167.21	1,644.43	31.8	3,522.78	68.2	
Increase		83.19	−97.07		180.26		(3)
Grand Rapids, Mich	July 1936	4,543.29	1,355.48	29.8	3,187.81	70.2	
	July 1937	4,884.72	1,409.93	28.9	3,474.79	71.1	
Increase		341.43	54.45		286.98		1.20
Detroit, Mich	July 1936	4,639.38	1,562.30	33.7	3,077.08	66.3	
	July 1937	5,585.42	2,007.05	35.9	3,578.37	64.1	
Increase		946.04	444.75		501.29		.80
District 7							
Chicago, Ill	June 1936	5,790.34	2,537.03	43.8	3,253.31	56.2	
	June 1937	6,336.27	2,678.11	42.3	3,658.16	57.7	
Increase		545.93	141.08		404.85		1.32
Milwaukee, Wis	June 1936	4,858.06	1,592.61	32.8	3,265.45	67.2	
	June 1937	5,957.19	1,710.66	28.7	4,246.53	71.3	
Increase		1,099.13	118.05		981.08		1.33
Oshkosh, Wis	June 1936	4,924.55	1,541.10	31.3	3,383.45	68.7	
	June 1937	5,057.19	1,522.73	30.1	3,534.46	69.9	
Increase		132.64	−18.37		151.01		1.67
District 8							
St. Paul, Minn	July 1936	4,838.61	1,676.65	34.7	3,161.96	65.3	
	July 1937	6,051.58	2,152.36	35.6	3,899.22	64.4	
Increase		1,212.97	475.71		737.26		.93
St. Louis, Mo	July 1936	5,160.82	2,225.46	43.1	2,935.36	56.9	
	July 1937	5,697.36	2,136.87	37.5	3,560.49	62.5	
Increase		536.54	−88.59		625.13		(3)
District 9							
New Orleans, La	August 1936	4,504.27	1,252.40	27.8	3,251.87	72.2	
	August 1937	5,298.32	1,458.54	27.5	3,839.78	72.5	
Increase		794.05	206.14		587.91		1.03
Houston, Tex	August 1936	5,098.24	1,590.26	31.2	3,507.98	68.8	
	August 1937	5,328.33	1,678.31	31.5	3,650.02	68.5	
Increase		230.09	88.05		142.04		.89
District 10							
Wichita, Kans	June 1936	4,547.75	1,098.50	24.2	3,449.25	75.8	
	June 1937	5,223.06	1,184.35	22.7	4,038.71	77.3	
Increase		675.31	85.85		589.46		1.16
Omaha, Nebr	June 1936	4,896.35	1,565.60	32.0	3,330.75	68.0	
	June 1937	4,736.18	1,168.38	24.7	3,567.80	75.3	
Decrease		−160.17	−397.22		237.05		(3)
District 11							
Portland Oreg	July 1936	4,647.72	1,648.30	35.5	2,999.42	64.5	
	July 1937	5,306.57	1,854.65	35.0	3,451.92	65.0	
Increase		658.85	206.35		452.50		1.06
Spokane, Wash	July 1936	5,009.36	1,634.13	32.6	3,375.23	67.4	
	July 1937	5,944.84	2,235.43	37.6	3,709.41	62.4	
Increase		935.48	601.30		334.18		.53
District 12							
Los Angeles, Calif	August 1936	4,644.52	1,604.44	34.5	3,040.08	65.5	
	August 1937	5,260.76	1,758.51	33.4	3,502.25	66.6	
Increase		616.24	154.07		462.17		1.14

[1] Source: Cost data from the Federal Home Loan Bank Board. The house on which costs are reported is a detached 6-room home of 24,000 cubic feet volume. Living room, dining room, kitchen, and lavatory on first floor; 3 bedrooms and bath on second floor. Exterior is wide-board siding with brick and stucco as features of design. Best quality materials and workmanship used throughout. The house is not completed ready for occupancy. It includes all fundamental structural elements, an attached 1-car garage, an unfinished cellar, an unfinished attic, a fireplace, essential heating, plumbing, and electric wiring equipment, and complete insulation. It does not include wallpaper nor other wall nor ceiling finish on interior plastered surfaces, lighting fixtures, refrigerators, water heaters, ranges, screens, weather stripping, nor window shades. The total figures in the above table include only labor and material. The discrepancies between the total figures in this table and those in table IX are explained by the fact that in table IX the costs shown include, in addition to material and labor costs, compensation insurance, an allowance for contractor's overhead and transportation of materials, plus 10 percent for builder's profit. Reported costs do not include the cost of land nor of surveying the land, the cost of planting the lot, nor of providing walks and driveways; they do not include architect's fee, cost of building permit, financing charges, nor sales costs. In figuring costs, current prices on the same building materials list are obtained from the same reputable contractors and operative builders.

[2] When ratio is more than 1.0 materials cost increased at a greater rate than combined materials and labor; when the ratio is less than 1.0 materials increased at a lesser rate, i. e., labor costs advanced at a greater rate than the combined increase.

[3] Ratios not shown because the decrease in labor costs so minimized the rise in tota costs as to give an exaggerated impression of the significance of changes in materia costs.

The figures in the last column deserve careful attention. In six cities, Providence, Nashville, Indianapolis, Oshkosh, St. Louis, and Omaha, all of the increase in building costs from June 1936 to June 1937 was due to increases in the prices of materials, none to labor. Since outlays for materials constitute from 60 to 70 percent of the on-site building costs, if materials and labor rise at the same rate, the increase in materials prices would account for 60 to 70 cents of each dollar of increase in total costs. When the ratio shown in the table exceeds one, the rise in materials prices was more rapid than that of total costs. This was the case in 18 of the 26 cities for the period from June 1936 to June 1937. How much greater is shown by the values of the ratios. In only eight cities did materials prices rise less rapidly than total costs, but in no case sufficiently less to make their absolute contribution toward increases in total building costs smaller than that of increases in labor costs.

It is also to be noted from table II that the material-labor ratios do not remain constant, since material prices and labor costs do not move uniformly at the same rate in the same direction. In the short period covered by this tabulation, the proportion of expense chargeable to materials increased in 18 of the 26 cities because materials prices increased more rapidly than did wages. Nevertheless, the tabulation indicates that the short-time fluctuations in the materials and labor ratios are limited to a rather narrow range.[5]

One further fact should be noted in table II, namely, the considerable differences in outlay required in the various cities to obtain the same quantity of building materials. In 1936 the figure varied from as low as $2,900 in Newark, N. J., to $3,500 in Houston, Tex. In 1937 the lowest figure of $3,200 in Richmond, Va., was a fourth lower than the highest figure of $4,250 for Milwaukee, Wis. Clearly these differences, while in part due to differences in freight rates, shift temporally and regionally in accordance with variations in distributive mark-ups, contractor bargaining power, and the like.

Thus far the discussion has centered upon the wooden frame single-family dwelling built under ordinary conditions. When other materials are used, or when multiple-family dwellings are erected, the ratios will differ considerably. In table III is contained a limited sample of diverse conditions, comparable only in a rough way. It shows the proportion of total costs attributable to wages to have been uniformly higher on multifamily dwellings than it was for single-family houses.

These data indicate that building materials constitute roughly from 50 to 70 percent of the combined cost of labor and materials. But building materials constitute a smaller percentage of the total capital cost of the home to the builder and to the buyer. To the cost of the structure itself must be added the price of the land.

TABLE III.—*Material costs vs. labor costs in various types of construction* [1]

Location	Type of structure	100=combined cost of material and labor	
		Material	Labor
Single-family houses (private contracts):			
Pontiac, Mich.[2]	150 houses built by the Oakland Housing Corporation.	62.8	37.2
Purdue University:[3]			
House No. 1	Wood frame and stucco	66.3	33.7
House No. 4, "steel house."	Walls and roof of prefabricated panels.	72.0	28.0
Multifamily houses (public contracts):[4]			
Atlanta, Ga	Techwood Apartments, P. W. A.	63.0	37.0
Miami, Fla	Liberty Square project, P. W. A.	56.2	43.8
Montgomery, Ala	Paterson Courts, P. W. A	59.2	40.8
Montgomery, Ala	Riverside Heights, P. W. A	58.9	41.1
Cleveland, Ohio	Cedar Central Apartments, P. W. A.	52.3	47.7
Washington, D. C	Alley Dwelling Authority, row type houses.	50.9	49.1

[1] Overhead and profit are not included. Building on these projects took place roughly in the period 1935–36.

[2] Source: *Architectural Record*, October 1936, vol. 80, No. 4, pp. 253–274.

[3] Source: *Better Homes in America*. House No. 1, vol. 1, Nos. 14 and 15, July and August 1936. House No. 4, vol. 1, Nos. 10 and 11, May and June 1936. Purdue University, Lafayette, Ind.

[4] Source of data for governmental projects: Bureau of Labor Statistics, Division of Construction and Employment.

The proportion of total cost due to land varies from time to time and from locality to locality, even within the same city or same portion of the city. In general, a figure in the neighborhood of 20 percent seems typical. In 1928, for example, the Veterans' Welfare Board of California reported that of the cost of veterans' homes, 22 percent on the average was charged against the lot, and that "the lot, unless under exceptional circumstances, should represent from 20 to 25 percent of the total cost of the home."[6]

Another study[7] summarizing information gathered from builders in 25 cities found that the average ratio of improved lot cost to total cost of house and lot was 20.2 percent, ranging from 17.7 percent in cities with 50,000 to 100,000 population to 25.7 percent in those with 500,000 to 1,000,000. Subdividers and officials of real estate boards in 64 cities gave a general average ratio of 18.1 percent between the cost of the improved lot and the total cost of house and lot. Thus, building materials form from 42 to 52 percent of the capital costs of the home.[8]

The Relative Significance of Different Building Materials

It has been shown that expenditures for material account for a larger proportion of the cost of hom construction than do labor costs. To lay the foundation for further analysis of building material prices in relationship to home construction, it is necessary to ascertain what materials are most important in this type of building.

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[5] For further discussion of labor costs, see section on "Labor and the Cost of Housing."

[6] Veterans Welfare Board of California, *Annual Report, 1928* (California State Printing Office, Sacramento, 1928), p. 33.

[7] Whitten, Robert, and Adams, Thomas. *Neighborhoods of Small Homes; Economic Density of Low-Cost Housing in America and England* (Harvard University Press, Cambridge, 1931), pp. 34–35, 155–157.

[8] Assuming that building materials range from 60 to 65 percent of the cost of the structure, and that the structure forms 70 to 80 percent of the cost of the home.

The answer to such a query will, of course, depend on several factors: the type of house, its style of architecture, the locality, freight rates, engineering economies, local supplies of building materials, their relative prices, individual shrewdness and bargaining ability in purchasing them, quantities purchased and specifications demanded by the architect, the building code, or the owner's whim.

Inasmuch as the house upon which major attention has been focused here is the detached frame dwelling, the figures in table IV provide a reasonable perspective concerning the importance of individual materials in the low-cost housing picture. It indicates that lumber is even more important than one might at first surmise. In fact, it takes from 45 to 55 cents of the building materials dollar, 6 to 11 cents going for unfinished lumber, 15 to 21 cents going for millwork (frames, doors, trim, etc.), and 19 to 23 cents going for finished lumber (shingles, siding, sheathing, flooring, etc.).

TABLE IV.—*Percentage distribution of expenditure for building materials in construction of a standard house in 26 cities, summer, 1937* [1]

Federal Home Loan Bank Board Districts and cities	Grand total	Lumber				Miscellaneous items	Mason materials	Hardware, miscellaneous	Painters' materials	Boiler, radiators and fittings	Plumbing
		Total	Unfinished	Millwork	Finished						
District 1:											
Boston, Mass	100.0	47.7	11.6	14.8	21.3	7.4	17.8	3.2	2.5	7.7	13.7
Providence, R. I	100.0	49.6	10.5	15.9	23.2	7.5	17.9	3.2	2.3	7.1	12.4
District 2:											
Newark, N. J	100.0	48.1	11.4	16.7	20.0	10.7	17.8	2.7	2.7	7.2	10.8
Albany, N. Y	100.0	49.4	10.5	19.4	19.5	6.6	18.9	2.6	2.5	7.1	12.9
District 3:											
Philadelphia, Pa	100.0	50.3	9.5	20.0	20.8	6.8	18.5	3.0	2.5	6.9	12.0
Pittsburgh, Pa	100.0	53.0	10.0	19.4	23.6	7.0	18.2	2.4	2.2	6.2	11.0
District 4:											
Birmingham, Ala	100.0	47.4	9.7	19.7	18.0	6.1	21.6	2.4	2.7	8.0	11.8
Tampa, Fla	100.0	50.5	9.2	17.9	23.4	5.6	19.7	2.9	2.6	7.3	11.4
Richmond, Va	100.0	47.4	8.0	17.2	22.2	5.9	19.7	2.9	2.9	8.2	13.0
District 5:											
Cleveland, Ohio	100.0	54.0	11.1	18.9	24.0	7.4	14.6	2.3	2.3	7.5	11.9
Nashville, Tenn	100.0	49.9	11.6	16.4	21.9	6.2	19.7	2.6	2.8	7.0	11.8
District 6:											
Indianapolis, Ind	100.0	49.7	10.2	19.1	20.4	7.0	16.5	2.8	2.6	10.0	11.4
Grand Rapids, Mich	100.0	53.4	11.7	20.1	21.5	6.3	16.8	2.7	2.4	7.2	11.2
Detroit, Mich	100.0	52.3	10.6	19.8	21.9	7.7	14.9	2.6	2.6	8.8	11.1
District 7:											
Chicago, Ill	100.0	54.2	10.8	19.8	23.5	6.7	14.0	2.6	2.4	7.5	12.6
Milwaukee, Wis	100.0	53.8	9.8	27.5	16.5	5.5	12.3	2.6	2.1	9.4	14.3
Oshkosh, Wis	100.0	46.9	11.3	15.2	20.4	6.9	19.1	2.9	2.6	8.8	12.9
District 8:											
St. Paul, Minn	100.0	55.4	11.2	21.7	22.5	5.3	15.9	2.5	2.3	7.0	11.6
St. Louis, Mo	100.0	49.4	9.5	18.7	21.2	7 0	16.8	2.6	2.3	9.5	12.4
District 9:											
New Orleans, La	100.0	53.5	10.3	21.1	22.1	4.3	19.5	2.7	2.8	6.8	10.4
Houston, Tex	100.0	41.4	9.0	18.0	14.4	6.1	22.3	3.4	3.1	9.4	14.3
District 10:											
Wichita, Kans	100.0	54.3	10.7	21.4	22.2	6.3	16.1	3.2	2.3	6.8	11.0
Omaha, Nebr	100.0	48.7	10.1	18.6	20.0	5.3	19.0	2.9	2.6	9.0	12.5
District 11:											
Portland, Oreg	100.0	44.2	5.4	19.4	19.4	5.4	20.2	2.6	2.9	9.5	15.2
Spokane, Wash	100.0	44.8	7.4	17.0	20.4	5.4	20.5	3.2	2.8	10.1	13.2
District 12:											
Los Angeles, Calif	100.0	52.0	8.1	24.0	19.9	6.6	15.1	3.4	2.6	8.2	12.1

[1] Source: Computed from data in files of Federal Home Loan Bank Board, Division of Research and Statistics. For a description of the house on which these costs are based, see the explanatory note to table II.

As between regions of the country the pattern is most irregular, greater differences appearing between two relatively contiguous cities such as New Orleans, La. (53.5), and Houston, Tex. (41.4), than between any two areas. In general the figures are low in lumber-surplus sections, such as Oregon and Washington, and high in interior lumber-deficit areas such as Ohio and Illinois. The variations as between localities for the various grades of lumber is even more striking, unfinished lumber in the Middle West taking more than twice the slice out of the materials dollar that it does in Portland, Oregon.

The next largest slice of the building materials dollar goes for mason's materials (brick, plaster, cement, lime), roughly 16 to 19 cents. Next in order comes plumbing, about 11 to 13 cents; then heating equipment, from 7 to 9 cents; and finally miscellaneous items, none of which individually takes more than 2 or 3 cents.

The building materials dollar has a different distribution when structural steel becomes part of the cost in other types of construction (see table VII). But even in the small frame house the cost of steel is important because so much equipment such as plumbing, stove, refrigerator, hardware, and lighting fixtures, have steel as part of their raw material.

Even when lumber was at 1931 and 1932 prices (30 to 40 percent lower than in 1937), its importance, especially for the cheaper houses, was almost equal to that of all other materials combined, and easily three times as great as any other set of materials, such as brick or plumbing equipment. In table V, for example, in the range of dwellings then costing less than $2,000, lumber, brick, plumbing equipment and plaster account for nearly 80 cents out of every dollar spent for building materials. In houses costing between $2,000 and $4,000 these four items account for about 70 cents out of every dollar. In the first type of house the lumber dealer

TABLE V.—*Percentage that cost of each class of material formed of total material cost of residential buildings, in 15 cities, 1931–32, by cost classes* [1]

Materials used in—	Cost class						
	All cost classes	Up to $1,999	$2,000 to $3,999	$4,000 to $5,999	$6,000 to $7,999	$8,000 to $9,999	Over $10,000
Total all classes	100.0	100.0	100.0	100.0	100.0	100.0	100.0
Excavating and grading	.1	0	(2)	.1	.1	.4	.1
Brickwork	12.9	8.1	10.6	16.0	14.6	9.0	10.2
Carpenter work	39 1	50.1	41.7	36.5	38.5	40.3	40.8
Tile work	3.1	1.2	2.5	3.2	3.9	2.7	3.1
Concrete and cement work	6.7	4.1	8.1	7.4	6.6	7.1	4.8
Electric wiring and fixtures	3.4	3.0	3.4	3.6	3.4	3.4	3.2
Heating	8.4	3.0	6.8	7.1	8.6	10.9	10.8
Plumbing	11.2	14.3	10.3	11.7	10.4	9.6	11.5
Plastering and lathing	6.4	6.1	5.8	7.5	5.8	6.4	5.3
Painting	3.2	3.3	4.0	2.8	2.3	2.9	3.9
Papering	.2	.6	.5	.2	.3	.3	(2)
Roofing	4.4	6.2	4.3	3.4	4.3	5.0	5.7
Miscellaneous	.9	-------	2.0	.5	1.2	2.0	.6

[1] Source: Bureau of Labor Statistics, Division of Construction and Public Employ, ment.

[2] Less than one-tenth of 1 percent.

gets one-half of the building materials dollar; in the second he gets two-fifths.

Another arrangement of the data, showing the materials not only in the structure, but those used around the yard in driveways, sidewalks, and so on, is depicted in table VI. In these residences, costing slightly over $4,000, lumber was economized, brick and cement being used instead. Even in such instances the lumber bill is about a third of the materials bill, indicating how limited is the amount of substitution that is practical even when lumber prices rise relative to alternative materials. The consumer has little leeway. Always the important materials remain lumber, brick, cement, and plumbing.

Table VI, it should be remarked parenthetically, adds an interesting detail to the previous discussion concerning materials versus labor expense. It shows that in plumbing, carpenter work, and masonry, where the expenditures for labor are ordinarily regarded as most likely to be out of line, practically two-thirds of the expense is incurred for materials and only one-third for plumbers, carpenters, and bricklayers.

Table VI.—*Percentage distribution of labor and materials cost for certain residential building in 15 cities of the United States by major operations; 1931–32* [1]

Cost item	Combined cost	Percent of combined cost	
		Labor	Materials
Excavating and grading	1.3	98.5	1.5
Brickwork	14.8	41.6	58.4
Carpenter work	27.3	32.9	67.1
Tile work	3.5	44.0	56.0
Concrete work	11.7	36.5	63.5
Electric wiring and fixtures	4.5	36.0	64.0
Heating and ventilating	6.6	24.7	75.3
Plumbing	10.1	20.3	79.7
Plastering and lathing	8.2	66.6	33.4
Painting	4.2	61.5	38.5
Papering	0.5	55.4	44.6
Roofing	1.8	32.3	67.7
Miscellaneous	5.5	24.8	75.2
Total	100.0	37.3	62.7

[1] Source: U. S. Bureau of Labor Statistics. *Monthly Labor Review*, October 1932, pp. 766–769.

The fact has already been mentioned that in certain parts of the United States, notably in and near our large metropolitan centers, the ordinary detached type of frame house so characteristic of small communities is not being constructed to nearly so great an extent as multiple-family or row-type dwellings. Now the latter, while continuing to use lumber and brick, ordinarily use a good deal of iron and steel and their products.

In table VII are given figures illustrating this metropolitan type of housing development. The noteworthy item in this table is the amazingly small percentage of the dollar spent for lumber in column A, and the high percentage spent for steel. In these government-constructed projects even the doors, window sashes, molding, and trim were made of steel.

Table VII.—*Percentage distribution of materials costs for low-cost housing projects, 1936* [1]

Type of materials	Value of material orders placed [2]	Percent of total		
		A [3]	B [4]	C [5]
All materials	$3,078,314	100.0	100.0	100.0
Electrical wiring, fixtures, equipment, and supplies	182,682	5.9	3.3	4.4
Forest products	261,328	8.5	28.3	31.9
Cork	16,484	.5	------	------
Lumber and timber	128,650	4.2	14.7	19.3
Millwork	116,194	3.8	13.6	12.5
Iron and steel, and their products	856,238	27.8	16.2	10.4
Cast iron pipe	58,030	1.9	3.7	------
Doors, window sash, frames, molding, trim, etc.	241,431	7.9	------	5.2
Hardware, builders	71,826	2.3	3.9	2.4
Metal furniture	57,952	1.9	.4	------
Metal lath and channels	46,393	1.5	.2	.4
Reinforcing and structural steel	264,887	8.6	3.0	2.1
Wire and wireworks products, not elsewhere classified	7,534	.2	2.7	.1
Other products of iron and steel	108,185	3.5	1.3	.2
Composition flooring and linoleum	27,793	.9	.5	------
Paints and varnishes	42,831	1.4	3.8	------
Heating and ventilating equipment and supplies	251,178	8.2	6.2	13.5
Plumbing supplies and fixtures, not elsewhere classified	304,086	9.9	10.2	13.1
Roofing, waterproofing, and caulking materials, not elsewhere classified	72,694	2.4	1.2	2.4
Sheet metal (copper)	15,789	.5	------	.2
Stone, clay, and glass products	1,004,536	32.6	29.7	18.1
Brick, hollow tile, and other clay products	248,245	8.1	8.1	1.0
Cement	117,634	3.8	3.6	1.3
Ceramic tile	15,277	.5	------	------
Concrete products, including premixed concrete	384,063	12.5	12.0	7.0
Glass	19,665	.6	------	1.0
Marble, granite, limestone, and other stone products	40,160	1.3	------	------
Sand and gravel	71,925	2.3	1.3	.9
Wall plaster, wallboard and insulating materials, not elsewhere classified	107,567	3.5	4.7	6.9
Materials not classified	59,159	1.9	.6	6.0

[1] Source: Materials cost data (except column C) assembled and prepared by the Bureau of Labor Statistics, Division of Construction and Public Employment.

[2] Contracts let by Procurement Division of the United States Treasury for materials for five low-cost housing projects financed from PWA funds: namely, the Techwood project, Atlanta, Ga. (21 buildings containing 604 dwelling units, 1 dormitory of 194 rooms, 11 buildings forming 186 garages, 1 building with stores, etc.); the Liberty Square project, Miami, Fla. (35 buildings with 243 dwelling units, etc.); the Paterson Courts project, Montgomery, Ala. (17 buildings with 156 dwelling units); the Riverside Heights project, Montgomery, Ala. (11 buildings with 100 dwelling units, etc.) and the Cedar Central project, Cleveland, Ohio (19 buildings with 650 dwelling units, etc.)

[3] Column A, computed from figures in preceding column.

[4] Column B, computed from figures not recorded here of amounts spent by the Alley Dwelling Authority of Washington, D. C., for materials to construct 12 row-type single dwellings in the Hopkins Place project.

[5] Column C, average per house on Westacres project of 150 houses built by the Oakland Housing Corporation, Pontiac, Mich. Copper pipe was used; no separate figure was given for paints and varnishes. *Architectural Forum*, vol. 80, No. 4, Oct. 1936, p. 260.

In general, however, table VII corroborates the evidence of the preceding tables and charts which indicated that lumber, brick, cement, and plumbing account for more than two-thirds of the ordinary expenditure for building materials. If these items rise considerably in price, they are bound to cause an increase almost as large in the cost of building, for they constitute 70 percent of the total outlays for building materials, or from 42 to 45 percent of the cost of the structure and 30 to 33 percent of the cost of the home. If they rise 20 percent, a 9 to 10 percent rise in building costs results. Conversely, if they decline 20 percent in price, a substantial reduction in the costs of construction occurs.

The Behavior of Building Materials Prices

It has been demonstrated that the cost of materials accounts for from one-half to three-fourths of the cost of residential construction and that the major items in the materials bill are lumber, brick, cement, and plumbing. The prices of materials, therefore, constitute an important influence in the final cost of construction. Fluctuations in material costs, other factors remaining constant, would presumably exert a powerful influence in retarding or stimulating construction. It is not, of course, the absolute price of materials that matters. It is the price of materials in relationship to the prices of other commodities and services that is significant. Therefore, an analysis of the movements of construction costs and building material prices is necessary in order to show the nature of their relationship to prices in general and to indicate the peculiarities in the movements of the prices of individual building materials. For illustrative purposes, price data for 1936 and 1937 will be used primarily.

Trends in Construction and Materials Costs

In 1936 and 1937 building costs rose sharply. Was the level from which building costs rose high or relatively low? In short, was the movement in the nature of a recovery from distress and depression levels or did it proceed from levels already high with relation to other prices?

Figure 31, depicting certain indexes of construction costs, affords the initial portion of the answer. While the indexes, due to different systems of weighting and construction, show considerable dissimilarity of movement, and though all of them are faulty,[9] none of them shows a drop in building costs during the depression (1930–33) exceeding 20 to 25 percent. Moreover, during the heyday of the NRA the indexes rose on the

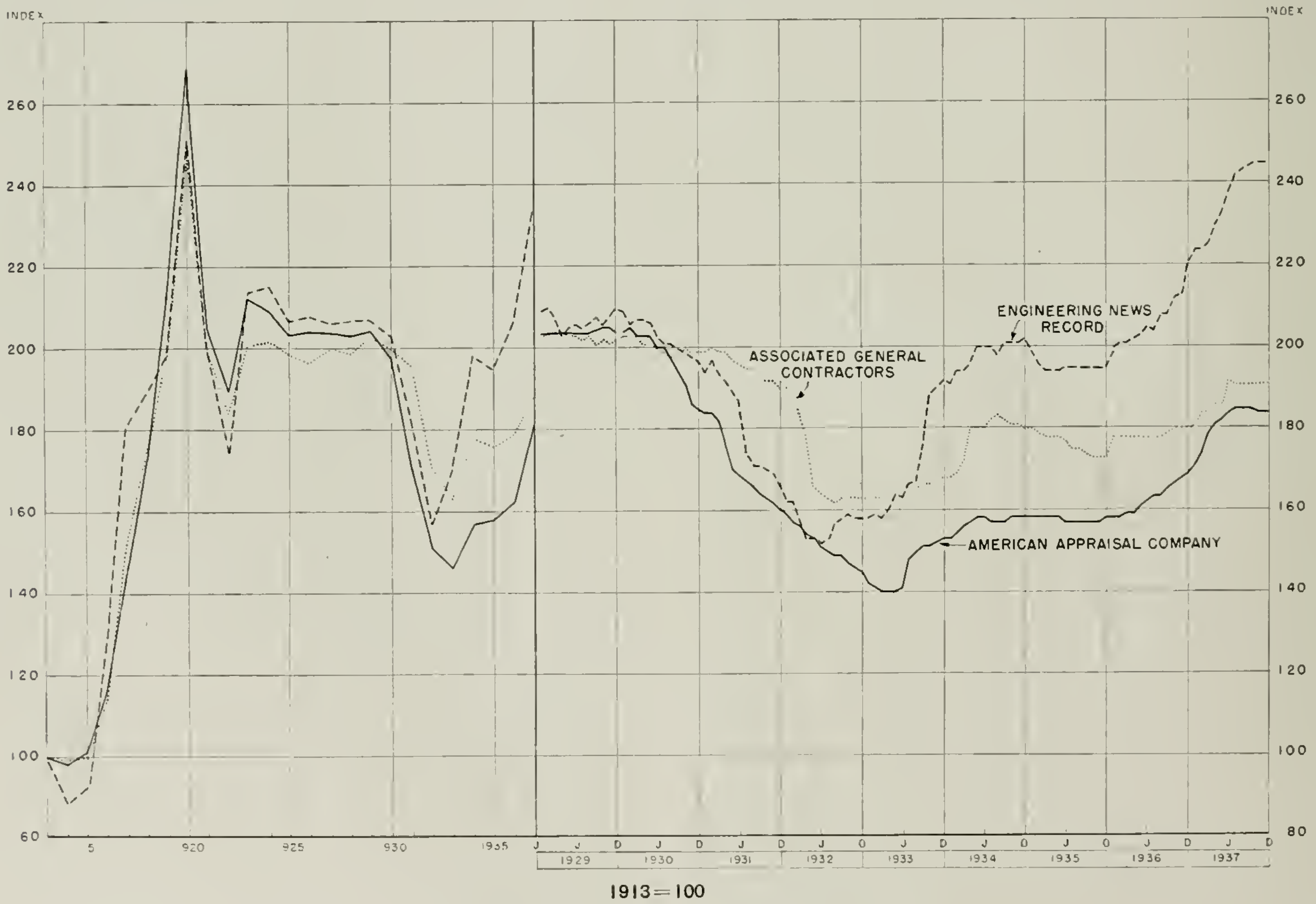

FIGURE 31.—Construction cost indexes, 1913–37.

Source: Survey of Current Business.

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[9] See Lowell J. Chawner, "Construction Cost Indexes as Influenced by Technological Change and Other Factors", *Journal of the American Statistical Association*, Sept. 1935, Supplement Vol. 30, pp. 561–576. Chawner points out that general national averages based on quoted prices hide an enormous amount of local variation in the actual costs at which residences are built. Furthermore, the component items of indexes like those described above are not limited to those going into residences, nor are they weighted in accordance with their importance in residential building. The net result is that certain materials are underweighted (in relationship to their significance in residential building) and others are overweighted because the amounts sold for other purposes are considerably larger than the amount sold for new residences.

average to within 10 percent of predepression levels. In 1937, one of them, that of the Engineering News-Record (so compounded as to be significant for heavy construction), showed a rise to levels more than 10 percent above any attained during the twenties and unmatched at any time in recent building history except during 1920.

The level from which the sudden jump of prices in 1937 took place was already high. The building materials index declined only 25.3 points between July of 1929 and February of 1933 while the index of prices in general declined 36.7 points. See figure 32. This disparity Dr. Frederick C. Mills declared to be an "important barrier to resumption of normal activity." [10]

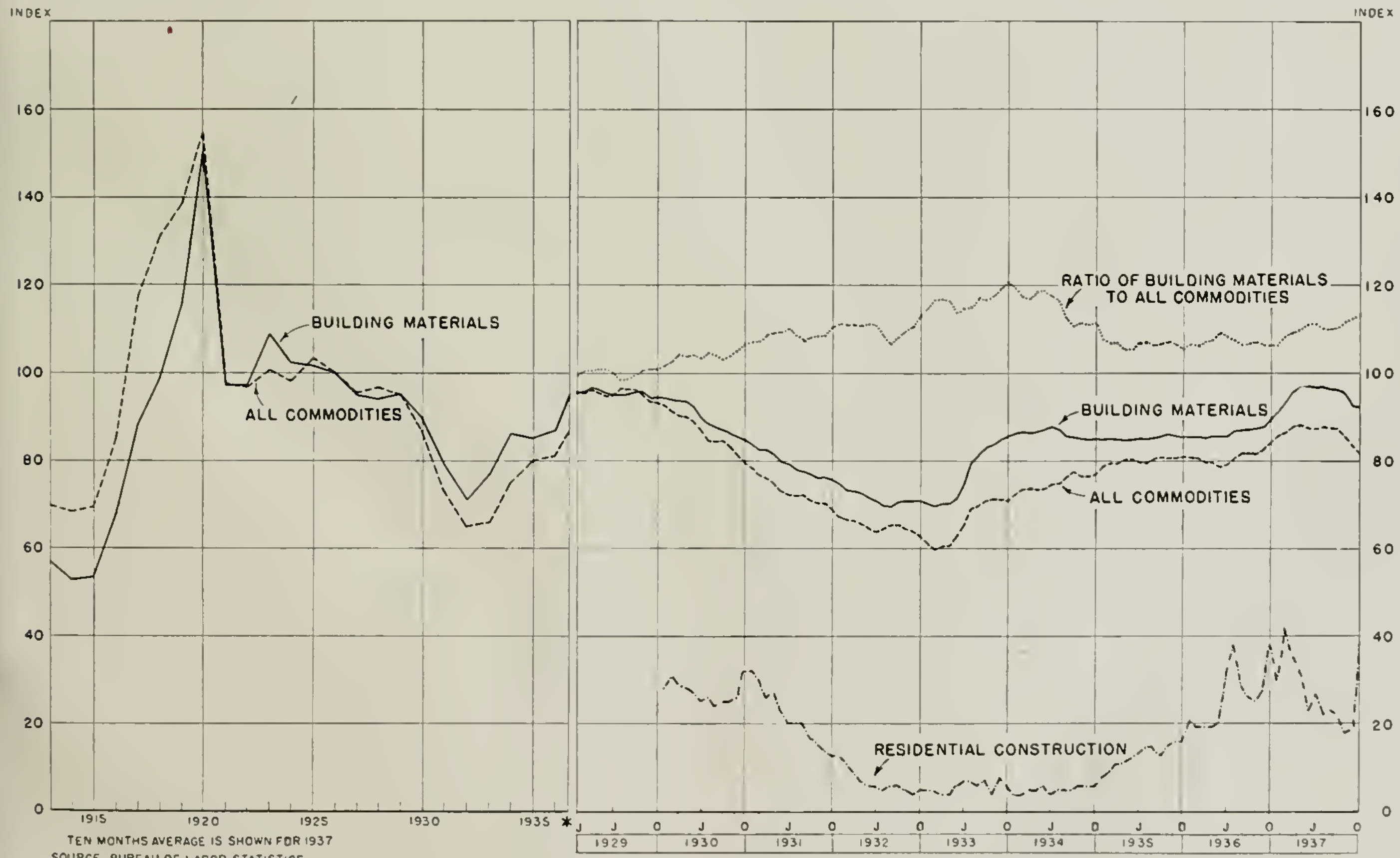
Building materials prices rose so much more rapidly than general prices in 1933 that their real costs became prohibitive. In 1934 the gap closed somewhat and still more so in 1935. As the relative dearness of building materials diminished, in many places beginnings of a recovery in building activity made their appearance.

But the marked price increases during 1937 again widened the gap. In July, in terms of general commodities, the exchange value of building materials not only exceeded 1926 levels by 10 percent but surpassed 1913 levels by more than 30 percent. In short, the prices of building materials were out of line not only with rents but with general prices and national income. The strength of the business urge to build houses, consequently, was seriously impaired.

The inescapable conclusion is that there has been a maladjustment between the materials industries and the whole economy because of the disparity in the rates of change of materials prices and other prices. Materials prices did not fall as far or as rapidly after 1929 as did other prices. Materials prices rose more rapidly and higher than did other prices after 1932. Moreover, from the summer of 1937 to the spring of 1938, materials prices did not decline as rapidly or as far as other prices.

Geographical Variations in Material Prices

The national averages in costs and prices shown in figures 31 and 32 conceal significant local variations. The absolute levels and the rate and time of change differ sharply from place to place. Moreover, wholesale prices of materials, such as those shown in figure 32, do not always move in consonance with labor costs, transportation rates, and other such elements entering into the final cost of construction, which are also important in geographical variations.



TEN MONTHS AVERAGE IS SHOWN FOR 1937

SOURCE BUREAU OF LABOR STATISTICS

1926 = 100

FIGURE 32.—Comparison between building materials prices and all commodities wholesale prices, 1913–37.

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[10] Frederick C. Mills, *Prices in Recession and Recovery* (National Bureau of Economic Research, 1936), p. 141.

The variation in residential construction costs from city to city is shown by the Boeckh index in table VIII. These variations in costs reflect, of course, such factors as differences in building code requirements, in transportation costs, in amount of competition among local contractors and suppliers of building materials, differences in types of building, in productivity of labor, in wage rates, and changes in engineering practices. In addition to the yearly average for 1937, the June 1937 figures are given in order to show the higher levels reached during that year. Note that in Cincinnati, Cleveland, Minneapolis, San Francisco, and Seattle, June costs were higher than the 1926–29 levels, and that in only four cities, Baltimore, Dallas, New York, and St. Louis, were costs more than 10 points lower. Particularly outstanding was the rise in the 1937 figures over costs in 1936.

The precise amount of this jump, and the variation between localities in this matter, are shown in table IX. The type of six-room frame house to which these figures apply is the same as that described in table II. Notice the unevenness of the pattern even within relatively small areas. As great a difference occurs between Milwaukee and Oshkosh, Wisconsin, for example, as exists between any two cities on opposite sides of the American continent. The largest increases took place in Washington, D. C., St. Paul, Pittsburgh, Philadelphia, Birmingham, and Milwaukee, all over 20 percent. The smallest increases took place in Indianapolis and Little Rock, only 1 percent. The modal increase was about 10 to 12 percent.

TABLE VIII.—*Cost of residential building in 16 metropolitan areas, 1935–37*

[U. S. average prices 1926–29=100]

Area	Frame					Brick				
	1926–29 average	June 1937	1937	1936	1935	1926–29 average	June 1937	1937	1936	1935
Atlanta	82.7	82.3	79.0	68.4	68.4	87.0	88.3	85.1	72.4	72.4
Baltimore	107.2	91.0	88.8	80.9	80.0	112.0	94.4	93.2	85.8	85.5
Boston	116.3	104.8	103.3	87.9	91.2	120.3	111.5	110.5	94.2	97.6
Chicago	109.2	104.8	104.8	97.2	91.5	114.2	111.1	110.7	102.9	97.9
Cincinnati	100.5	101.1	98.8	84.5	86.4	105.0	108.4	106.1	89.9	92.3
Cleveland	107.2	109.2	105.1	91.7	87.6	113.4	116.6	112.3	98.8	94.5
Dallas	103.1	91.4	89.9	82.5	82.8	107.3	96.9	95.2	87.1	88.9
Detroit	103.3	95.3	93.9	80.6	78.1	108.4	101.8	100.7	85.9	83.4
Minneapolis	92.8	103.7	101.6	88.6	82.7	98.2	109.2	107.6	93.6	88.6
New Orleans	93.3	84.9	83.4	73.4	76.2	96.3	88.2	87.0	78.8	81.3
New York	133.3	115.0	110.5	96.4	92.2	138.4	119.4	115.8	101.8	92.5
Philadelphia	100.3	91.0	91.4	88.7	85.4	106.3	97.7	98.0	95.5	91.9
Pittsburgh	113.3	107.1	109.8	92.8	84.1	118.8	114.5	117.5	100.4	90.5
St. Louis	118.6	99.2	98.2	91.0	91.6	121.1	107.8	106.5	99.1	99.7
San Francisco	87.7	96.4	96.7	86.5	84.1	93.7	104.9	104.3	95.6	91.6
Seattle	84.5	94.4	92.6	79.8	81.1	92.2	105.5	103.5	86.5	88.6

Source: Index of E. H. Boeckh & Associates, Inc., consulting valuation engineers, Cincinnati, Ohio. Reprinted by permission.

Trends in the Prices of Individual Materials

General indexes of building material prices, such as those shown in figure 32, do not reveal the characteristics of the behavior of the prices of individual materials just as they do not show geographical variations. Information with reference to recent price movements

TABLE IX.—*Cost of building the same standard house in representative cities in June 1936 and June 1937* [1]

Federal Home Loan Bank districts, States, and cities	Total building cost, June 1937	Cubic-foot cost		Percent increase June 1936–June 1937 [2]
		June 1937	June 1936	
No. 1—Boston:				
Connecticut:				
Hartford	$6,365	$0.265	$0.236	12.3
New Haven	5,933	.247	.231	6.9
Maine:				
Portland	5,916	.247	.214	15.4
Massachusetts:				
Boston	6,487	.270	.241	12.0
New Hampshire:				
Manchester	5,888	.245	.228	7.5
Rhode Island:				
Providence	5,932	.247	.229	7.9
Vermont:				
Rutland	5,710	.238	.222	7.2
No. 4—Winston-Salem:				
Alabama:				
Birmingham	6,077	.253	.209	21.1
District of Columbia:				
Washington	6,234	.260	.207	25.6
Florida:				
Tampa	5,716	.238	.223	6.7
West Palm Beach	6,411	.267	.246	8.5
Georgia:				
Atlanta	5,410	.225	.204	10.3
Maryland:				
Baltimore	5,402	.225	.205	9.8
Cumberland	5,732	.239	.226	5.8
North Carolina:				
Asheville	4,968	.207	.199	4.0
Raleigh	5,580	.232	.211	10.0
Salisbury	4,746	.198	---	---
South Carolina:				
Columbia	4,886	.204	.196	4.1
Virginia:				
Richmond	5,248	.219	.209	4.8
Roanoke	5,391	.225	.202	11.4
No. 7—Chicago:				
Illinois:				
Chicago	7,260	.302	.277	9.0
Peoria	6,833	.285	.267	6.7
Springfield	6,980	.291	.269	8.2
Wisconsin:				
Milwaukee	6,780	.282	.231	22.1
Oshkosh	6,087	.254	.234	8.5
No. 10—Topeka:				
Colorado:				
Denver	6,712	.280	.252	11.1
Kansas:				
Wichita	5,927	.247	.215	14.9
Nebraska:				
Omaha	5,969	.249	.233	6.9
Oklahoma:				
Oklahoma City	5,823	.243	.232	4.7
No. 2.—New York: [3]				
New Jersey:				
Atlantic City	6,173	.257	.239	7.5
Camden	5,866	.244	.211	15.6
Newark	6,474	.270	.241	12.0
New York:				
Albany	6,048	.252	.222	13.5
Buffalo	6,501	.271	.237	14.3
Syracuse	---	---	.232	---
White Plains	6,857	.286	.241	18.7
No. 6—Indianapolis: [3]				
Indiana:				
Evansville	5,816	.242	.233	3.9
Indianapolis	5,890	.245	.242	1.2
South Bend	6,395	.266	.244	9.0
Michigan:				
Detroit	6,379	.266	.221	20.4
Grand Rapids	5,560	.232	.216	7.4
No. 8—Des Moines: [3]				
Iowa:				
Des Moines	6,483	.270	.255	5.9
Minnesota:				
Duluth	6,373	.266	.236	12.7
St. Paul	6,911	.288	.230	25.2
Missouri:				
Kansas City	6,198	.258	.221	16.7
St. Louis	6,512	.271	.246	10.2
North Dakota:				
Fargo	6,062	.253	.234	8.1
South Dakota:				
Sioux Falls	6,263	.261	.238	9.7
No. 11—Portland: [3]				
Idaho:				
Boise	6,273	.261	.234	11.5
Montana:				
Great Falls	7,134	.297	.275	8.0
Oregon:				
Portland	5,990	.250	.221	13.1
Utah:				
Salt Lake City	6,375	.266	.241	10.4
Washington:				
Seattle	6,642	.277	.237	16.9
Spokane	6,796	.283	.238	18.9
Wyoming:				
Casper	---	---	.261	---

TABLE IX.—*Cost of building the same standard house in representative cities in June 1936 and June 1937* [1]—Continued

Federal Home Loan Bank districts, States, and cities	Total building cost, June 1937	Cubic-foot cost		Percent increase June 1936–June 1937 [2]
		June 1937	June 1936	
No. 3—Pittsburgh: [4]				
Delaware:				
Wilmington	5,737	.239	.220	8.6
Pennsylvania:				
Harrisburg	6,186	.258	.227	13.7
Philadelphia	5,944	.248	.203	22.2
Pittsburgh	6,730	.280	.225	24.4
West Virginia:				
Charleston	5,857	.244	.228	7.0
No. 5—Cincinnati: [4]				
Kentucky:				
Lexington	5,887	.245	.213	15.0
Louisville	6,111	.255	.222	14.9
Ohio:				
Cincinnati	6,321	.263	.243	8.2
Cleveland	6,756	.281	.256	9.8
Columbus	6,352	.265	.230	15.2
Tennessee:				
Memphis	5,704	.238	.213	11.7
Nashville	5,421	.226	.212	6.6
No. 9—Little Rock: [4]				
Arkansas:				
Little Rock	5,285	.220	.217	1.4
Louisiana:				
New Orleans	5,911	.246	.211	16.6
Shreveport	5,961	.248	------------	------------
Mississippi:				
Jackson	5,849	.244	.222	9.9
New Mexico:				
Albuquerque	6,358	.265	.234	13.2
Texas:				
Dallas	6,143	.256	.234	9.4
Houston	6,391	.266	.247	7.7
San Antonio	6,284	.262	.231	13.4
No. 12—Los Angeles: [4]				
Arizona:				
Phoenix	6,742	.281	.255	10.2
California:				
Los Angeles	6,015	.251	.218	15.1
San Diego	6,141	.256	.224	14.3
San Francisco	6,407	.267	.251	6.4
Nevada:				
Reno	6,641	.277	.263	5.3

[1] Source: Federal Home Loan Bank Board. Figures subject to correction. For a description of the house on which costs are reported, see the explanatory note to Table II.

[2] Computed. [3] July data. [4] May data.

of individual materials will indicate more clearly the nature of the price behavior of building materials and will point toward an explanation of some of the underlying factors governing that behavior.

Some of the important facts concerning the prices of lumber, brick, steel, and cement are shown in figure 33. Notice the steep rise after December 1936, especially in lumber and steel, the items mainly responsible for the rise in the wholesale price index of building materials. Both of them in 1937 exceeded 1926 levels. The increase from June 1936 to June 1937 was 20.1 points for lumber and 22.4 points for steel. During the same period the building materials index rose 11.1 points and the all commodities index rose 8.0 points. Lumber and brick were making considerable readjustment downward before the end of 1937, but steel and cement remained high. The other constituents of the general building materials index, in addition to being of lesser importance, rose little; paint and paint materials 4.1 points, plumbing and heating equipment 4.9 points, and miscellaneous materials 11.0 points.

Particularly noteworthy in figure 33 are the "staircase" movements in the prices of steel and cement, both of them being in that group of prices often referred to as "administered" or "managed." Their movements indicate infrequent and sluggish response to changes in demand, curious ability to stick at high levels, singular resistance to the impact of even so severe a depression as that of 1932, and rapid post-depression attainment of high levels. Staircase movements not dissimilar to those in cement and steel are typically found for the materials which show periods of prolonged inflexibility in prices in table X.

The fact must, however, be recognized that, though wholesale list price quotations remain identical, individual buyers may obtain varying actual net prices because of varying discounts, terms, and allowances. With due regard to this consideration, it is still difficult to label these prices highly competitive. The situation indicates control by business men over market prices, a control which is an aid to, and results from, the exercise of something akin to monopolistic power.[11]

Under a competitive system in which individual producers have no control over market price and each producer makes full adjustment of his output to market price, production would not drop, if the price remained steady. Supply falls off only when price falls off. Yet in the autumn of 1937 the volume of steel production went down to less than 25 percent of capacity, while prices remained unchanged. In short, the fundamental reasons for the rise or decline of many building material prices are those which influenced the decisions of business executives in certain of the materials industries, not those forces usually referred to as competitive.

Limitations of space do not permit a detailed study of the forces behind the data in table X. These data show first of all that the prices of the most important kinds of lumber were, in June 1937, from 15 to 25 percent higher than in 1929, and one important item was as much as 34 percent higher than in the base year 1926 Plaster was double what it was in 1929, cast-iron soil pipe 49 percent higher, even sand and face brick were more than 10 percent higher.

The last column, likewise, merits particular study. It shows that the prices of commodities in those industries in which the lower price levels prevail are as inflexible as the prices of those industries in which higher price levels prevail. The crucial difference, however, lies in the fact that the former are finished products such as plumbing and heating equipment, paint, and specialty hardware, products ready to be delivered to the consumer often under advertised trade-marks,[12] while the latter are raw materials or semiprocessed goods such as softwood lumber, structural steel products, sand, and cement. Moreover, the former usually apply to the products of one firm in one market, while the latter are in many cases composite figures of prices quoted by many plants in many markets. Needless to say, such composites show a larger degree of flexibility than actually exists, for they change whenever price quotations change in any one of the several markets covered.

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[11] See especially Dr. J. K. Galbraith's "Monopoly and Price Rigidities," *Quarterly Journal of Economics*, May 1936, vol. 4, No. 3, pp. 456–475.

[12] In some cases, however, the actual installed cost to the consumer of these finished products which did not rise to 1929 wholesale price levels were in some localities raised to high levels through the competitive practices prevailing among contractors and subcontractors.

Prices of Lumber, Brick, Steel, and Cement

Limitations of space again preclude showing the variations in price that exist for nearly every one of the 39 items listed above, variations between wholesale and retail prices, variations between distributing outlets, shifts in the pattern of price spreads geographically and through time. The extent of such variations from the single figure given above should not be underestimated. In table XI, for example, a cross section of geographic price spreads is given for typical building materials, as purchased under standard specifications by the Works Progress Administration in June 1937. Notice in the column on the extreme right that combined cost in Montana, Colorado, North Dakota, and Wisconsin was a third higher than that in California, Florida, Oregon, Texas, or Illinois.

The interstate variation in the individual items was even larger. Lumber in Washington, South Carolina, and Alabama cost less than half the sum required in Wisconsin, Utah, New York, and Iowa. Cement was nearly twice as high in Washington as in California or Michigan. Ten yards of crushed stone or gravel cost only $9.80 in Massachusetts and $30.75 in South Carolina. Concrete reenforcing bars were twice as

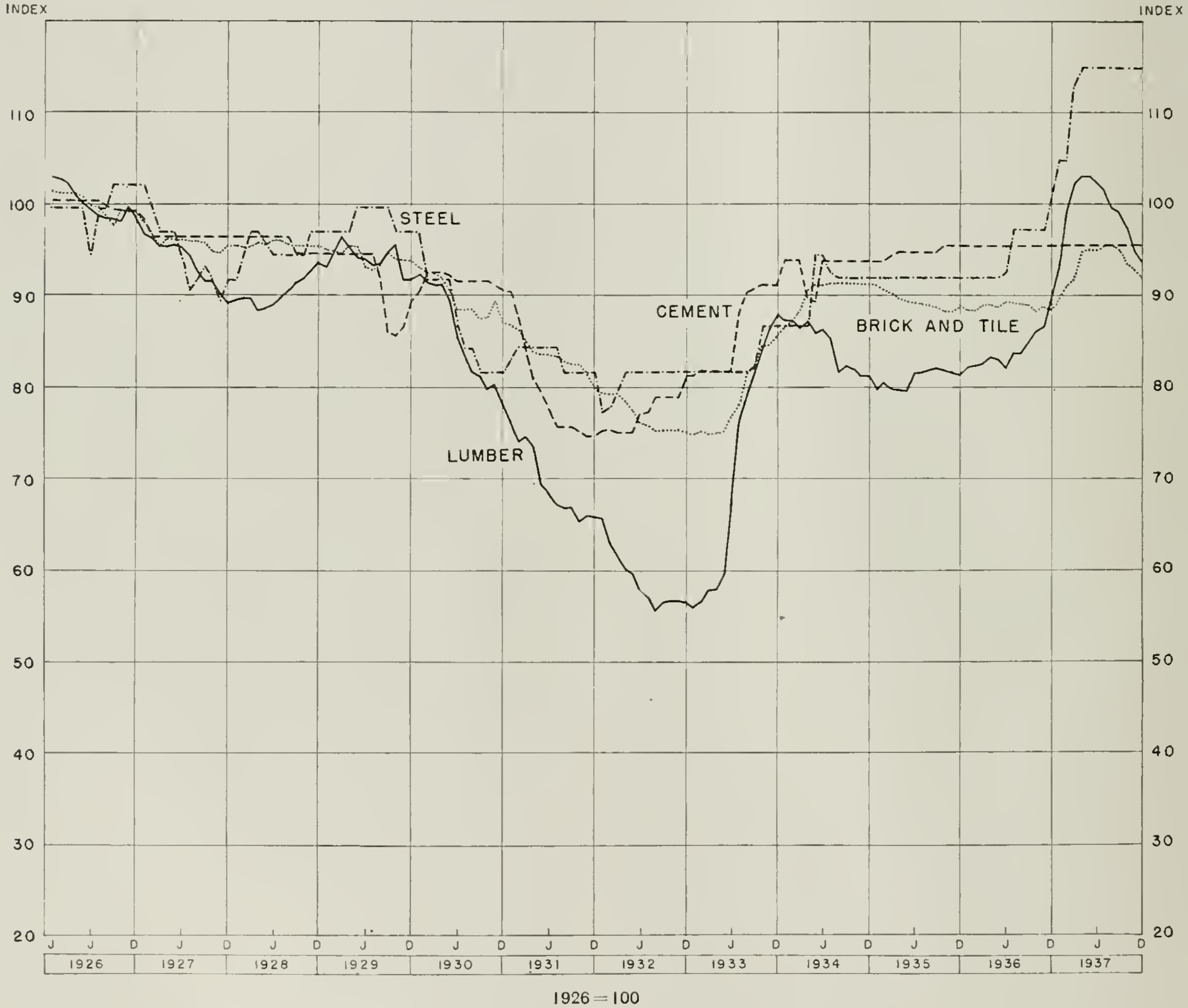

FIGURE 33.—Wholesale price trends of four principal building materials, 1926–37.

Source: U. S. Bureau of Labor Statistics (wholesale prices).

TABLE X.—*Price increases in the most important individual building materials 1929, 1936, and 1937* [1]

Building material	Price index (1926=100)			Percent change 1929–37	Periods of price inflexibility	
	June 1929	June 1936	June 1937		Period	Level
Materials above 1929 levels in price in 1937:						
Douglas fir boards, 1 inch by 8 inches.	113.7	-----	134.3	18	April 1927 to April 1928	98.5
Douglas fir drop siding.[2]	102.1	-----	105.1	3	----------	-----
Douglas fir plaster lath.	84.1	97.0	97.0	15	January 1936 to January 1937.	110.6
White pine window sash.[3]	100.0	93.7	128.7	29	January 1926 to June 1930. August 1935 to November 1936.	100.0 93.7
Western pine window frames.[4]	98.5	84.8	103.0	5	January 1926 to March 1928. August 1934 to April 1936	100.0 77.6
White pine standard doors.[3]	101.6	94.1	121.4	19	January 1926 to December 1928. January 1929 to June 1930 August 1935 to November 1936.	100.0 101.6 94.1
White pine door frames.[3]	98.7	83.7	106.2	8	January 1926 to March 1928. August 1934 to April 1936	100.0 76.5
Yellow pine flooring [2]	82.1	80.7	96.5	18	----------	-----
Red cedar shingles [4]	114.2	114.8	124.9	9	(5)	(5)
Prepared roofing, individual shingles.[2]	76.2	85.3	103.0	35	(5)	(5)
Prepared roofing, strip shingles.[3]	76.2	85.3	103.6	36	(5)	(5)
Plaster, per ton	62.5	125.0	125.0	100	January 1926 to November 1927. February 1931 to December 1933. February 1934 to December 1937.	100.0 112.5 125.0
Cement	94.6	95.6	95.6	1	April 1935 to December 1937.	95.6
Common building brick.[3]	66.8	63.2	91.3	37	----------	-----
Light colored front brick.[2]	84.9	82.9	94.4	11	July 1929 to January 1931 June 1932 to June 1933 May 1934 to August 1935.	82.2 74.2 89.0
Building sand [4]	90.6	98.2	102.2	13	----------	-----
Structural steel [3]	99.6	92.4	114.9	15	----------	-----
Asbestos pipe covering.[3]	92.0	92.0	108.0	17	October 1928 to August 1930. September 1931 to July 1933. November 1935 to July 1936.	92.0 80.0 92.0
8-penny wire nails [3]	100.0	80.0	103.6	4	----------	-----
Cast iron 6-inch soil pipe.[2]	69.3	88.0	103.2	49	July 1935 to November 1936.	88.0
Galvanized sheets [3]	91.9	71.0	96.2	5	August 1934 to May 1936	78.5
Materials which did not reach 1929 levels in price in 1937:						
Rough barn white pine No. 2.[2]	99.9	81.9	93.4	−6	December 1934 to May 1935.	79.0
Plain white oak No. 1 [3]	87.9	68.2	83.0	−6	July 1932 to May 1933 July 1935 to December 1936.	60.6 68.2
Insulation building board.	82.8	75.9	75.9	−8	July 1926 to November 1928. December 1928 to August 1930. October 1933 to August 1935 and since May 1936.	94.3 82.8 75.9 75.9
Mason's lump lime	87.4	79.2	78.5	−10	----------	-----
Builder's varnish	100.0	95.3	95.3	−5	January 1926 to January 1931. December 1933 to December 1935. January 1936 to December 1937.	100.0 86.1 95.3
House paint, all shades.	100.0	92.3	92.3	−8	January 1926 to July 1929. December 1933 to December 1935.	100.0 88.0
Inside flat wall paints, all shades.	85.0	78.0	76.5	−10	January 1926 to October 1927. September 1929 to December 1930. February 1931 to May 1932. July 1933 to December 1936.	100.0 90.0 84.0 78.0
Hollow building tile	97.1	89.9	89.9	−7	January 1927 to August 1930. April 1934 to June 1937	97.1 89.9
Linoleum [4]	107.4	90.6	95.1	−11	January 1926 to November 1927. October 1933 to September 1934. January 1935 to December 1936.	100.0 94.3 90.6
Materials which did not reach 1929 levels in price in 1937—Con.						
Window glass, American grade A.	107.7	76.7	69.7	−35	(6)	(6)
Black steel pipe, ¾-inch.[2]	100.0	83.3	96.2	−4	January 1926 to January 1928. May 1934 to January 1936.	100.0 92.6
Galvanized steel pipe [2]	100.0	82.0	94.0	−6	January 1926 to February 1928. May 1934 to January 1936.	100.0 91.2
Radiation by steam or water.[4]	118.1	93.1	99.8	−16	December 1928 to June 1930. July 1936 to August 1937	118.1 99.8
Heating boilers [4]	97.0	77.0	87.8	−9	August 1935 to June 1936 July 1936 to August 1937	77.0 82.8
Bathtubs, enameled	79.0	66.7	66.7	−16	January 1926 to January 1927. March 1927 to April 1928 January 1931 to December 1931. February 1936 to December 1937.	100.0 85.0 74.1 66.7
Water closets	111.5	63.1	63.1	−43	February 1936 to July 1937.	63.1
Sinks, ordinary kitchen.	80.3	55.7	55.7	−31	January 1926 to January 1927. March 1927 to April 1928 February 1929 to February 1930. January 1931 to December 1931. February 1936 to December 1937.	100.0 85.0 80.3 77.9 55.7
Common mortise locks.[3]	120.3	66.2	84.2	−30	----------	-----
Knobs, steel, bronze plated.[3]	114.3	57.1	74.3	−35	January 1926 to December 1927.	100.0

[1] Data from Bureau of Labor Statistics, Division of Wholesale Prices. Percentages computed.

[2] Increases in price from June 1936 to June 1937 more than 10 percent but less than 20 percent.

[3] Increases more than 20 percent.

[4] Increases under 10 percent.

[5] Staircase price movements.

[6] Chaotic shifts in price in 1937.

Those with no superior figures did not increase in price, June 1936 to June 1937.

cheap along the Atlantic and Pacific seaboard as in the Rocky Mountain area. Even brick costs varied by 75 percent, 600 brick costing $6 in Illinois, Texas, and New Mexico, and $10.50 in Washington and Colorado, $10.80 in Wyoming and Minnesota. The figure of $16.20 in North Dakota is, of course, exceptional.

How far the price increases noted in table X occurred in each of the various States and cities is, of course, a matter of too great detail to present here. *A priori*, there seems no reason to believe that these price rises were either uniform in time and amount or horizontal in character to such an extent as to maintain substantially the price contours indicated in table XI. The forces which lead to price changes could hardly be of equivalent strength and effectiveness in each region.

Factors of demand as registered by the volume of residential construction balanced against factors of supply as measured by production, shipments, costs, or stocks, in 1937 would have retarded rather than supported rising prices. No one can say that the embryonic building boom shown in figure 30 represented an insistent demand of proportions strong enough to send

TABLE XI.—*Prices of 5 principal construction materials in 27 States as of June 15, 1937*

	Lumber (440 feet)	Cement (6 barrels)	Crushed stone or gravel (10 yards)	Steel (280 pounds reinforcing bars)	Brick (600)	Total
Alabama	$9.24	$12.00	$19.90	$7.62	$7.63	$56.39
Arizona	18.11	----------	----------	13.02	----------	----------
Arkansas	11.00	15.36	16.00	10.28	9.00	61.64
California	16.17	10.50	10.70	8.62	7.20	53.19
Colorado	17.09	14.64	15.00	14.73	10.50	71.96
Connecticut	----------	14.58	29.70	----------	7.20	----------
Delaware	14.30	13.08	14.50	----------	----------	----------
Florida	11.75	12.00	16.10	6.83	6.60	53.28
Georgia	11.00	12.06	23.50	8.40	6.58	61.54
Idaho	13.06	16.98	12.00	12.49	6.60	61.13
Illinois	13.55	12.48	16.00	6.92	6.00	54.95
Indiana	15.40	13.98	15.00	9.52	9.30	63.20
Iowa	21.12	14.16	20.00	8.92	----------	----------
Kansas	18.48	13.44	----------	----------	----------	----------
Kentucky	15.40	13.56	17.50	8.57	8.10	63.13
Louisiana	11.48	12.90	21.40	7.22	9.14	62.14
Maryland	10.92	13.08	14.50	10.64	9.60	58.14
Massachusetts	17.24	12.42	9.80	8.57	9.30	57.33
Michigan	14.74	10.50	18.60	9.24	9.40	62.48
Minnesota	14.52	15.00	14.00	8.68	10.80	63.00
Mississippi	12.10	15.48	15.90	8.54	6.30	58.32
Missouri	13.42	13.02	16.40	8.96	9.00	60.80
Montana	----------	----------	----------	----------	----------	83.91
Nebraska	18.48	15.54	----------	9.04	8.55	----------
Nevada	15.40	17.40	20.00	----------	----------	----------
New Hampshire	----------	13.53	14.50	----------	----------	----------
New Jersey	16.13	11.25	13.90	7.53	6.88	55.69
New Mexico	13.20	19.08	----------	8.96	6.00	----------
New York	18.73	11.58	12.50	8.86	6.90	58.57
North Carolina	----------	15.21	27.04	----------	8.70	----------
North Dakota	17.16	18.66	29.25	8.32	16.20	89.59
Ohio	12.76	13.32	14.00	8.40	9.55	58.03
Oklahoma	17.60	14.10	16.70	7.56	7.50	63.46
Oregon	10.68	14.10	15.70	6.83	8.40	55.71
Pennsylvania	15.40	13.20	16.90	8.85	9.00	63.35
South Carolina	10.19	12.60	30.75	----------	----------	----------
South Dakota	----------	14.88	----------	----------	----------	----------
Tennessee	12.32	15.18	15.37	9.34	8.25	60.46
Texas	16.28	12.90	12.00	8.57	6.00	55.75
Utah	18.80	16.80	----------	14.00	8.10	----------
Virginia	14.70	14.46	21.60	----------	9.00	----------
Washington	9.20	19.80	19.60	6.83	10.50	65.93
West Virginia	----------	13.32	26.00	----------	8.40	----------
Wisconsin	19.36	14.58	18.75	8.74	8.70	70.13
Wyoming	18.70	17.64	----------	10.10	10.80	----------

Source: Works Progress Administration, Construction Statistics Section.

TABLE XII.—*Shipments of construction materials, 1925–38*

[Index of 30 items unadjusted for seasonal variation (monthly average 1929=100)]

	1925	1926	1927	1928	1929	1930	1931
January	68	69	67	71	69	57	49
February	73	67	73	71	67	59	45
March	95	90	95	95	90	72	54
April	116	106	107	102	103	88	69
May	125	130	119	125	114	98	79
June	124	133	128	125	116	99	82
July	129	131	123	125	121	101	81
August	134	137	139	138	134	102	79
September	129	134	131	129	120	102	77
October	126	133	126	137	121	97	76
November	95	102	97	101	84	62	51
December	80	73	71	74	61	47	34
Average	108	109	106	108	100	82	65

	1932	1933	1934	1935	1936	1937	1938
January	34	25	32	34	45	58	45
February	32	24	29	34	43	59	43
March	36	31	39	43	59	73	66
April	45	38	48	54	71	83	--------
May	48	51	58	59	78	85	--------
June	51	57	53	58	89	88	--------
July	47	59	50	60	91	85	--------
August	57	51	60	67	95	90	--------
September	56	52	55	70	104	98	--------
October	55	52	64	75	106	86	--------
November	34	36	46	51	75	60	--------
December	24	29	33	42	62	43	--------
Average	43	42	47	54	76	76	--------

Source: Compiled by the Federal Employment Stabilization Board, the Public Works Administration, and the National Resources Committee.

prices skyrocketing. Nor were shipments particularly heavy. As is shown in table XII, they at no time reached volumes even 60 percent as high as were accomplished at lower levels of prices in 1927 and 1928. There was scarcely a semblance of a strain on productive capacity.

While wages and other costs of producing materials rose noticeably in some cases, such increases did not occur exclusively in the areas or in the plants of the manufacturers producing the building materials the prices of which rose most. Plumbing and heating equipment and paints, for example, are produced precisely in the centers of the most highly publicized wage increases and utilize craft labor of highest skill. Nor does the factor of wage increase explain why the prices of lumber, for example, should rise in areas where it is produced by low-paid labor. Nor does labor expense constitute in most cases a sufficiently large proportion of total costs to make a 20 or 30 percent rise in wages mean more than a 4 or 6 or 8 percent increase in total costs.

In short, the balance of general forces during 1936 and 1937 would seem to have favored at most only moderate price rises in building materials.

This presents a puzzle to which hardly any clue exists save that shown in the column on the extreme right in table X. There, it will be remembered, the fact emerged clearly that at no time in recent industrial history save possibly the period from 1926 to 1929 have more building materials enjoyed longer periods of stability and inflexibility in price than in the years 1935 and 1936.

Factors Influencing the Prices of Individual Building Materials

For detailed analyses of the bottle-necks which restrict the flow of production in individual industries, the reader is referred to competent industrial monographs such as that of Professors Daugherty, de Chazeau, and Stratton in the *Economics of the Iron and Steel Industry* [13] or that of the National Recovery Administration in *Economic Problems of the Lumber and Timber Products Industry*.[14] Here, only the briefest of thumb-nail sketches can be given of two industries, lumber and steel. The first was selected because of its overwhelming importance in residential construction and its framework of competition moderated by able trade association leadership; the second, because of its potential role in some types of residential construction and its underlying importance as a raw material in many of the items which are used in house equipment and accessories. These two industries with brick, cement, and plumbing equipment, it will be remembered, account for most of the building materials dollar. Although brick prices also rose in 1936 and 1937, lumber and steel price increases were among the most formidable obstacles to the recovery of the construction industry.

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[13] McGraw-Hill, New York, 1937, 2 vols.

[14] Division of Review, *Work Materials No. 79*, March 1936 (mimeo).

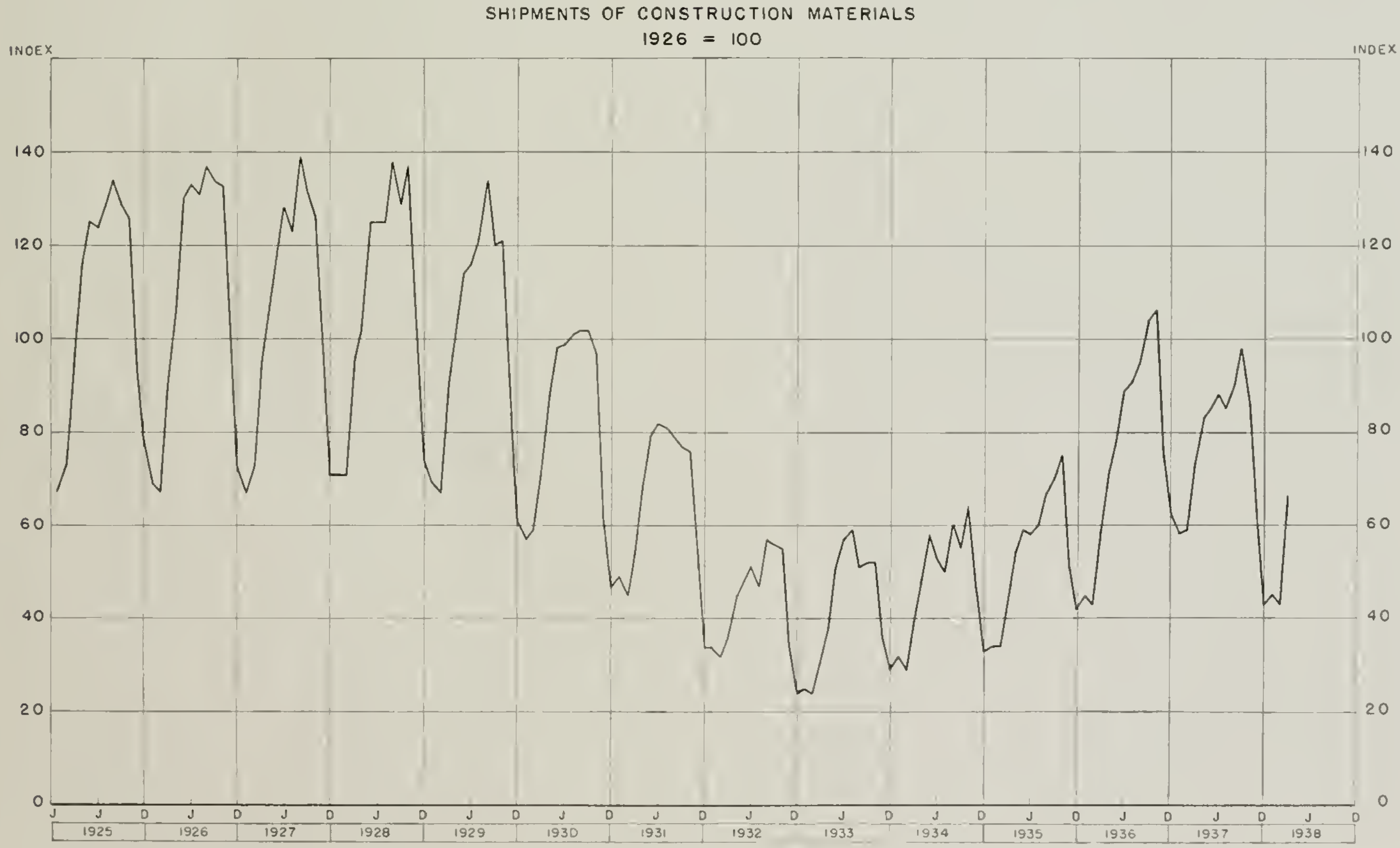
Lumber Prices

Beginning with lumber, let us recall a few well-known facts. Some sort of lumber is manufactured in practically every State of the Union, and it is both imported and exported, often from and to the same foreign country. Within the industry there are really several entirely different businesses. Moreover, there are well over 25,000 sawmills, about 35,000 retail lumber yards, and several thousand wholesalers. Among these exist a variety of manufacturing, distributing, and selling policies, and combinations thereof.

It is at once the industry of small cross-roads enterprises and gigantic corporations. Numerous competitive complications exist: Competition with lumber substitutes; unequal freight rates between manufacturers and consumers equally distanced; competition between species suitable to the same purpose; competition of various grades; smaller manufacturers compelled to undersell larger manufacturers to offset the advantages the latter have in more economical and extensive distribution facilities in a product of superior quality and of a greater degree of refinement (such as drying methods, use of preservative treatments, the production of completed items); competition created by the disorganization in the channels of trade; and, finally, the effect of various transportation methods and fluctuation in water rates.

The importance of transportation is sometimes inadequately realized. At Atlantic seaports the average landed price paid for west coast lumber in 1936 was $26.03 per thousand; during the same period, the water freight rate was $12 per thousand until August, when it advanced to $12.50. Thus freight rates account for nearly 50 percent of the price of loaded lumber from the West Coast. In 1934, the cost to the retailer of western pine was $40.23, $23.33 of which represented total mill costs, and $16.79 of which went for freight.[15]

When intercoastal rates are high or when there is a tonnage scarcity in eastern markets usually in part supplied by Pacific coast shippers, southern mills will increase their shipments into such markets. The western pine mills which ship by rail also acquire a new relative advantage in eastern markets over Pacific coast competitors. Such developments were among the results of the west coast shipping strike, which from November 1936 until February 1937 tied up and delayed (water) shipments of lumber from the Pacific Northwest. West coast water shipments to the Atlantic coast fell from 657 million feet in October 1936 to 396



SOURCE: PUBLIC WORKS ADMINISTRATION, PROJECTS DIVISION, AND FEDERAL HOUSING ADMINISTRATION, DIVISION OF ECONOMICS AND STATISTICS.

FIGURE 34.—Shipments of construction materials, January 1925–March 1938.

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[15] U. S. Department of Commerce, N. R. A. Division of Review, *Works Materials No. 79*, March 1936.

million feet in December and 325 million feet in January 1937 (far more than a seasonal decline); and southern pine shipments during this same period increased from 699 million feet in October 1926 to 701 million feet in December (a remarkable increase, since the seasonal trend is downward during the winter months)[16] and 659 million feet in January 1937. Shipments of western pine from the Inland Empire during November–February likewise were heavier than usual.

It is difficult to determine the extent to which lumber price behavior indicated in table X was due to the effects of the west coast shipping strike, and to what extent it was due to other factors in the industry already mentioned. Total shipments for the strike period held up remarkably well,[17] stocks on hand for the year decreased (fig. 35) less than might be expected under the circumstances, and production continued at a reasonably constant rate.[18]

The strike itself undoubtedly had some effect on the supplies of certain lumber types in eastern markets, and temporarily damaged the competitive position of the west coast lumber operators. Moreover, the increased demand for lumber in January 1937, directly related to the increase in volume of building, may be considered a factor in the price rise during the winter and spring of 1937.

TABLE XIII.—*Weekly earnings and hourly wage rates in the sawmill industry in various lumber-producing areas, July 1936 and July 1937* [1]

State	Weekly earnings [2]		Hourly wage rates		
	July 1936	July 1937	July 1936	July 1937	Percent increase
			Cents	*Cents*	
Wisconsin	$14.12	$16.01	34.2	41.4	21.1
Minnesota	19.11	17.96	46.7	54.7	17.1
California	23.09	26.37	60.7	69.3	14.2
Washington	23.29	25.82	67.1	76.9	14.6
Louisiana	9.68	10.95	28.8	31.6	9.7
North and South Carolina	13.34	14.75	21.7	24.8	14.3

[1] Source: U. S. Bureau of Labor Statistics. Percent increase computed.

[2] Includes part-time workers.

Furthermore, in some areas there were moderate wage increases of varying amounts during 1936 and early 1937, as is indicated in table XIII. However, labor costs are only a minor portion of total costs (see table XX). Moreover, the increases in wage rates were unequal in different parts of the country. They should be checked against rising lumber prices in corresponding areas. However, while the Bureau of Labor Statistics index of wholesale prices for lumber increased 21 percent from July 1936 to July 1937, detailed price data for geographical areas for comparison with the above wage rates are not available. Historically, the unfavorable earnings record of the industry suggests little immediate relationship between costs and prices. In the main, other considerations explain price increases.

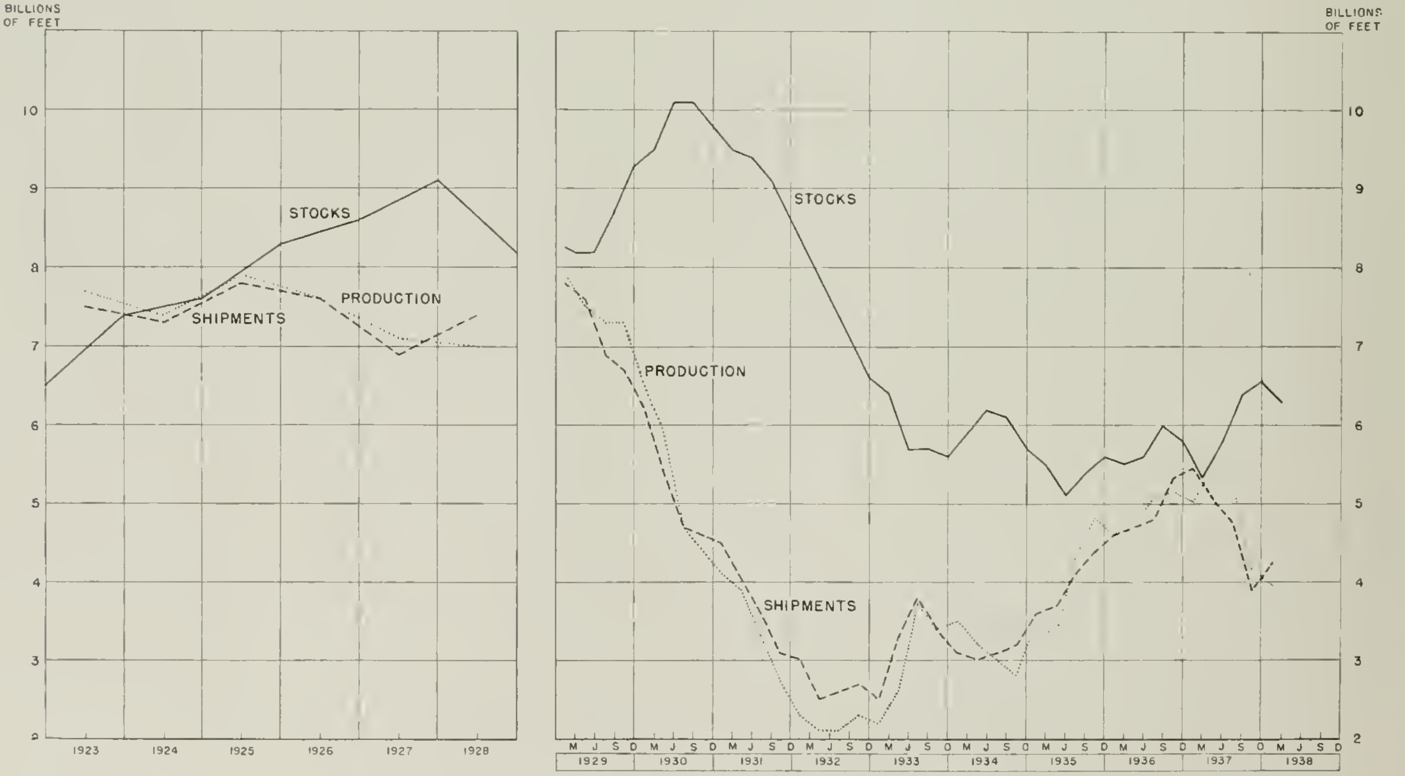

FIGURE 35.—Softwood production, shipments, stocks.

Source: National Lumber Manufacturers Association.

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[16] National Lumber Manufacturers Association. *Total Shipments by Months*, February 1938.

[17] *Ibid.*, 1937.

[18] *Ibid.*, 1936 and 1937.

Figure 35 indicates to a substantial degree those factors generally classified under such headings as demand and supply. It shows the relationship of production, shipments, and stocks of lumber, from 1923 to the end of 1937. The scissors effect both in 1923 and 1937, in production and stocks, should be noted particularly. In both years the prices of lumber reached high peaks. In both periods a subsequent widening of the gap impelled prices of lumber to weaken.

In the lumber industry, dominated as it is by various types of competition, it is only natural for attempts to be made to bring supplies and prices under control. The industry has many regional trade associations as well as a national association, which have for many years distributed information on production, stocks, orders, and shipments, so that individual producers can operate more intelligently. For a generation, complaints have appeared from time to time charging the industry with various types of combination and only after decisions by the Supreme Court has the legality of certain practices of the associations been established.[19] In 1931 a Timber Conservation Board was appointed by the Federal Government. One of the committees of this Board was the Lumber Survey Committee,[20] which reports quarterly to the Department of Commerce. It is clear that such an agency may make recommendations which could in no wise be interpreted as being collusion or conspiracy on the part of the industry. Indeed, "if the board found that among the difficulties of the industry was that of overproduction, they could so state and set forth the remedy in a much more authoritative way than could any other organization." [21]

During the decline in demand in the fall of 1937, the Committee said:

> Although the Committee recommends that further increases in lumber stocks should follow, but not anticipate, revival in demand, it finds that the weakness in the lumber manufacturing industry in most regions is not in its stocks but in the low point to which unfilled orders have now declined and the continuing general decline in new business. Due consideration should be given * * * to the combined effects of large stocks, lower volume of unfilled orders, lower expected demand during the next quarter and the momentum of current production schedules. Effort to adjust current production more closely to current demand should be continued in both the lumber and plywood manufacturing industries.[22]

The reasoning behind such recommendations ran as follows:

> Price stability in the lumber industry is preeminently desirable. In some regions fluctuations in the past three months have been small. More dependable price levels will aid building revival. The record of the past few years indicates that building does not increase in an era of declining prices and costs; rather the contrary, as evidenced by the boom years of 1925–29 and the low years of 1932–34.[23]

The recommendation was continued in February 1938:

> The current effort to reduce stocks and build up order files is bringing the industry to a more balanced market condition. The present determined efforts to reduce heavy surpluses should be continued.[24]

Not too much weight should be assigned to the recommendations of such a committee as a factor influencing prices. Even when supported by information collected and distributed by the various lumber manufacturers associations, the control by such activities can easily be overestimated. Probably the advice would result more easily in price rises during periods of favorable demand than in holding prices up during periods of declining demand. But since the ultimate control over prices lies in the control of production, these attempts at supply control cannot be discounted completely in a discussion of price increases.

It should be noted also that in the spring of 1937 when lumber prices were rising rapidly the Lumber Survey Committee referred not so much to increasing costs of producing lumber as to distortions produced in the lumber market by other disturbing factors. The Committee called attention to the fact that there were adequate supplies except in a limited number of items. There was no danger of lumber shortage. Furthermore, it expressed the judgment that prices were rising in a manner which was apt to destroy demand and interfere with the marked growth in residential building characteristic of that period. "The lumber industry should discourage 'lumber famine' propaganda and should resist artificial pricing of its products." [25] The Committee's warning was amply supported by the events of the summer and fall of 1937.

A final word of caution should be kept in mind. The sketchy analysis given above throws light on only one circumstance; namely, the movement of lumber prices in 1936 and 1937. It does not cover such facts as costs, consumption, production, profits, taxes, wastes, and the like, nor does it deal with long range problems such as the reasons for the fact that lumber prices during the twenties stayed on a plateau about twice as high as the pre-war levels. It points out that after breaking somewhat during the depression (though not as did the prices of other commodities to lower than pre-war levels) lumber prices promptly rose to levels which, "out of line" in 1926,[26] came in 1937 to be even more out of balance with prices in general, with rents and with consumer incomes.

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[19] *U. S.* v. *American Column and Lumber Company*, 257 U. S. 377 (1921); *U. S.* v. *American Linseed Company*, 262 U. S. 371 (1923); *Maple Flooring Manufacturers' Association* v. *U. S.* 268 U. S. 563.

[20] The Lumber Survey Committee appointed on July 9, 1931, consists of Thomas S. Holden, vice president, F. W. Dodge Corporation, New York; M. W. Stark, economist, Columbus, Ohio; Calvin Fentress, chairman of the board, Fentress & Co., Chicago; Phillips A. Hayward, Chief, Forest Products Division, Department of Commerce; and Wilson Compton, secretary and manager, National Lumber Manufacturers' Association.

[21] A. C. Dixon, in "*Economic Problems of the Lumber and Timber Products Industry*," by Peter Stone et al., N. R. A. Division of Review, *Work Materials No. 79*, March 1936, pp. 247–49.

[22] Lumber Survey Committee. Release of November 15, accompanying report of November 8, 1937, to the Department of Commerce (mimeograph).

[23] *Ibid.*, report of Nov. 8, p. 1.

[24] *Ibid.*, report of Feb. 12, 1938, p. 1.

[25] *Ibid.*, report of Feb. 10, 1937, p. 2.

Nor does the above discussion consider, in explaining the post-war shift of lumber prices to higher levels, such other factors as the gradual reduction in the total stand of certain kinds of timber, the depletion in certain instances of readily available cheaply processed stumpage, the dispersion of the lumber industry to points of new or more abundant supply further removed from principal consuming markets, together with countervailing technological improvements in methods not only of cutting and logging the raw timber but also of manufacturing, transporting, and handling lumber.[27]

In short, the lumber industry is suffering from an aggravation of old maladies, not from anything new.[28] At bottom collectivistic business attempts at production and price control are symptoms rather than causes, symptoms, namely, of basic economic ills of long standing for which the lumber industry has found no cure, ills which have been analyzed in numerous official State and Federal documents and elsewhere.[29]

Steel Prices

Turning to the steel industry let us keep in mind the same caution. Without attempting to summarize the many penetrating analyses of the fundamental economic structure of the iron and steel industry [30] let us try briefly to single out the factors that may have accounted for the abrupt jump in steel prices in 1936 and 1937.

In contrast with the lumber industry which produced in the summer of 1937 only 56.6 percent of its average weekly cut in the period 1926–29, and operated its plants only 4 days a week, the steel industry operated then at unusually high levels of capacity. This means for an industry of such heavy capitalization as steel with its relatively large percentage of fixed costs that overhead costs per ton of steel were substantially reduced.

The actual amount of reduction varies of course from plant to plant, and from operation to operation, so that even were detailed cost figures available they would portray the general situation less adequately than those given in table XIV. Notice that overhead costs per ton of output were lower for the first half of 1937 than in any year of recent steel history. It is also apparent that there was a rapid increase in the autumn as steel production was reduced.

TABLE XIV.—*Hypothetical overhead costs per ton of steel output (assuming interest and depreciation at 5 percent of total investment)*

A. AT VARIOUS LEVELS OF PRODUCTION WITH 1937 CAPITALIZATION

Percent of capacity operation	Output of finished steel (gross tons, at assumed capacity)	5 percent of total 1937 capitalization	Cost per ton of output
80	39, 200, 000	$220, 000, 000	$5. 61
70	34, 300, 000	220, 000, 000	6. 41
60	29, 400, 000	220, 000, 000	7. 48
50	24, 500, 000	220, 000, 000	8. 98
40	19, 600, 000	220, 000, 000	11. 22
30	14, 700, 000	220, 000. 000	14. 96
20	9, 800, 000	220, 000, 000	22. 45

B. HISTORICALLY AT LEVELS OF OUTPUT AND CAPITALIZATION THEN EXISTING

Year	Average percent of capacity [1]	Approximate out put of finished steel (gross tons) [2]	5 percent of total capitalization [3]	Cost per ton of output
1926	83. 5	33, 805, 000	$197, 708, 500	$5. 85
1929	88. 5	40, 633, 000	200, 172, 150	4. 93
1932	19. 5	10, 352, 000	203, 680, 000	19. 68
1933	33. 1	16, 605, 000	198, 973, 000	11. 98
1936	68. 4	32, 000, 000	191, 668, 000	5. 99
1937	72. 4	32, 531, 800	220, 000, 000	6. 76
1937 [4]	84. 8	40, 000, 000	220, 000, 000	5. 50

[1] *Annual Statistical Report of the American Iron and Steel Institute* (350 5th Ave., New York), 1936 p. 15; and *The Iron Age*, Mar. 10, 1938, p. 55.

[2] *The Iron Age*, Mar. 10, 1938, p. 58. Output for 1937 [4] estimated.

[3] Estimate for the entire industry based on figures given in *Steel*, Apr. 11, 1938.

[4] At rate of first half.

It is clear that overhead costs per ton vary inversely with the volume produced. The cost of raw materials, however, used to manufacture steel has a more direct relation to the cost of the finished product and these costs were rising. Due to the insistent export demand for scrap, combined with heavy domestic demand, in the first half of 1937 the price was 103 percent above that for the corresponding half of 1936. The best grade of steel scrap sold for $22.50 per gross ton at Pittsburgh in comparison with a quotation of $19 per ton in 1929. One grade of pig iron sold at $23.50 in comparison with $18.50 per ton in 1929.

Labor costs are often assumed to have the same relation to costs as raw materials. However, the higher hourly rates paid to labor in 1937 seem not to have been reflected in proportionate increases in labor costs per ton. (See table XV, column 5.) Although the hourly rate rose from 0.670 to 0.819 (22.2 percent) the wage bill per ton of structural steel rose only from 10.52 to 12.29 (16.8 percent).

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[26] For a complete and authoritative discussion of these propositions see Mills, Frederick C., *Prices in Recession and Recovery* (National Bureau of Economic Research, publication No. 31, 1936), especially pp. 364–9.

[27] For a description of these trends, see U. S. Forest Service, *A National Plan for American Forestry*, Senate Doc. No. 12, 73d Cong., 1st sess., 1933.

[28] More than 30 years ago congressional resolutions inquiring about high prices and combinations in the lumber industry ordered the Bureau of Corporations of the Department of Commerce and Labor to conduct an investigation which lasted from 1907 to 1910, the results of which, entitled *The Lumber Industry*, were published in 3 parts in 1913 and 1914 (Washington, Government Printing Office). See also: Appendix 1, "Efforts of the Lumber Industry at Production Control," N. R. A. *Work Materials No. 79, op. cit.*

[29] U. S. Federal Trade Commission. *Report of the Federal Trade Commission on Lumber Manufacturers' Trade Associations*, incorporating reports of Jan. 10, 1921, Feb. 18, 1921, June 9, 1921, Feb. 15, 1922, Washington, Government Printing Office, 1922; *The Red Cedar Shingle Industry*, report of the United States Tariff Commission to the President of the United States upon the red cedar shingle industry in the United States and Canada, Washington, Government Printing Office, 1927; Forest Service, *Timber Depletion, Lumber Prices, Lumber Exports, and Concentration of Timber Ownership*, report on Senate Resolution 311, June 1, 1920; Forest Service, *A National Plan for American Forestry*, Senate Document No. 12, 73d Cong., 1st sess., 1933, Washington, Government Printing Office.

[30] See especially the study of *Daugherty, et al.*, mentioned above and the extensive bibliography quoted therein.

The reason for this becomes apparent when reference is made to the fact that, as output increases, the number of man-hours required to produce a ton of steel decreases.[31]

Another noteworthy feature here is the fact that the proportion going into pay rolls was almost exactly the same in 1936 as it was in 1929. In other words, while the steel industry paid its labor in 1937 higher average rates per hour than any other industry in the country except the automobile industry (Bureau of Labor Statistics figures were $36.20 per week and 85.0 cents per hour for steel in April 1937 as opposed to $35.90 per week and 65.0 cents in 1929) "total monthly pay rolls of the industry" by July 1937 had "risen 175 percent since 1933 while production * * * increased 173 percent."[32] Interest, taxes, depreciation and depletion, and pay rolls took the same share of the sales dollar in 1936 that they did in 1929. The slice of the sales dollar spent for materials, however, was nearly a third larger.

TABLE XV.—*Fluctuations in cost of items entering into the manufacture of structural steel shapes, 1926–37*

Year	Pig iron, per ton [1]	Scrap, per ton [2]	Average hourly wages [3]	Average man-hours per ton of structural steel [4]	Wage bill per ton of structural steel	Taxes paid per ton of finished steel [5]	Selling price of structural steel per ton [6]
1926	$18.55	$15.48	$0.636	14.3	$9.09	$2.60	$43.68
1929	18.19	16.30	.654	14.3	9.35	2.91	43.01
1932	13.98	7.54	.531	23.6	12.53	5.97	35.17
1933	15.24	9.47	.523	22.2	11.61	3.66	37.63
1936	19.10	14.75	.670	15.7	10.52	3.34	41.44
1937	22.99	18.02	.819	15.0	12.29	4.96	49.50

[1] Basic Pig Iron at Mahoning or Shenango Valley Furnace, Gross Ton, *The Iron Age* Annual Review Number, Jan. 6, 1938, p. 102.

[2] No. 1 Heavy Melting Steel Scrap Composite Price. *Ibid.*, p. 113.

[3] 1926–32 from *Wages, Hours and Employment in the United States, 1914–36*, National Industrial Conference Board, September, 1936; 1933–37 from U. S. Bureau of Labor Statistics.

[4] Exclusive of pig iron. The amount varies with rate of operations (see first column, B section of table XV). These computations are estimates based on the figures contained in Man-Hours of Labor per Unit of Output in Steel Manufacture. *Monthly Labor Review*, May 1935, p. 1155 ff. (reprinted as U. S. Department of Labor Bulletin No. R 240), which gives 17.46 man-hours as required for making structural shapes (not fabricated) with plants operating at 55–60 percent of capacity. At capacities above 55–60 percent, the index of man-hours required per ton was extrapolated as follows: 60–65, 95; 65–70, 90; 70–75, 86; 75 and over, 82.

[5] Taxes from *Steel Facts*, April, 1938, p. 1.

[6] Structural Shapes at Pittsburgh, *The Iron Age*, Jan. 6, 1938, p. 107. Computed from cents per pound.

The main conclusion to be drawn from this sketchy analysis is that there is little relationship between the costs of production of steel at any particular time and the price at which the steel is sold at that time, a fact well known to cost accountants and other persons acquainted with the industry.

Evidently those persons who judge the market in establishing steel prices are not dominated wholly by cost elements. They no doubt also consider what the "traffic will bear" in pushing prices up. They probably again take this demand element into account in making any adjustments downward.

One could hardly expect steel producers to refuse to take advantage of the situation in 1937. Whether they marketed their product as pig iron, scrap, plates, shapes or structural steel was obviously a matter of indifference. But so long as steel prices remain high they will continue to obstruct recovery in housing construction.

In conclusion the fact should be emphasized that long-range factors in the steel industry have not been considered in this analysis. The industry has a long record of increasing efficiency, of technological change, of price control.

It is hoped that the two examples given here—lumber and steel—have revealed to some extent the knotty character of the problem, the interindustry entanglements, the various monopolistic obstructions, and other difficulties which enter into the complicated behavior of building materials prices.

Inefficiencies in Distribution of Building Materials

The inefficiencies of retail and wholesale distribution of building materials are a matter of common knowledge. The editors of *Fortune* in their book, *Housing America*, have characterized the situation as follows:

> Since so much material is, or has been in the past, ordered in special lots and special quantities and special sizes selling necessarily at special prices, the material men have come to think of their products universally in those terms. Nothing else explains the notorious price spread in building materials, certainly averaging 100 percent, nor the fact that a man finds himself in a completely new and different world of values, a sort of fairyland of prices, the moment he undertakes to buy anything having to do with a house. A brass bowl which applied to another use might possibly cost $25 will cost $200 if he wishes to attach it to his ceiling for the purpose of diffusing light. And 15 cents' worth of metal and enamel may in an extreme case cost him $15 by the time it has been applied as a replacement to the top of his water-closet reservoir. As an example of the ripening of prices in the jobber's warehouse, the history of plain copper gutter has considerable eloquence:
>
> | | | *Cents* |
> |---|---|---|
> | Ingot copper | per pound | 7½ |
> | Cost of melting, rolling, cutting, etc., including freight and manufacturer's overhead and profit | per pound | 6¾ |
> | Manufacturer's price | per pound | 14½ |
> | Which amounts to | per foot | 11½ |
> | Wholesaler's selling costs and profit, including freight, warehousing, overhead, and profit | per foot | 6½ |
> | Roofer's selling costs and profit, including costs of handling and storing | per foot | 18 |
> | Retail price | per foot | 36 |
> | Which amounts to | per pound | 45 |
>
> (Or three times the manufacturer's price).

Obviously, then, the man of means who wishes a house after his own heart, although he may justly demand of the building industry that it find some means of selling him his materials and his labor and his financing at prices commensurate with the prices holding in other industries, has no right to compare housing costs with, say, automobile costs, for if he built his $2,000 car as he builds his house, it would cost him for parts alone upward of $5,000.[33]

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[31] "Man-Hours of Labor per Unit of Output in Steel Manufacture," *Monthly Labor Review*, May 1935, p. 1155 ff. (Reprinted as U. S. Department of Labor Bulletin No. R240.)

[32] *Steel Facts*, July 1937, p. 1.

Retailing Building Materials

The manner in which materials are purchased for the ordinary home is shown in table XVI. The net result of such buying practices is, of course, a multiplicity of dealers in the business of furnishing building supplies. In 1935, according to the Census of Business, there were more than 73,000 retail dealers in the lumber-building-hardware group with average volume of sales of only $24,000. Almost a fourth of them had total sales of less than $5,000 each. In fact, only 139 lumber and building materials dealers in the United States sold more than $300,000 worth of product, and they made only one-eleventh of all sales.

Probably in no industry is the criss-cross pattern of distribution more complex than in the building materials industries. Some materials are ordinarily delivered direct to the customer, as, for example, sand and gravel. Some are obtained at general merchandise stores, some at hardware stores, some direct from the manufacturer or the wholesaler. Building materials dealers frequently handle other products, lumber yards handling fuel, oil, coal, garden supplies and the like.

The pattern of distribution in the industry has been profoundly influenced by the development of trade associations which have sought to prevent drastic readjustments in the distributive processes in this industry. The associations are sometimes composed of local building material dealers, or of dealers in a particular commodity, or of manufacturers of materials; all of which proliferate into both regional and national organizations. The spheres of influence of the organizations of manufacturers and retailers often overlap and interlock, both within themselves and with each other.

The activities of these organizations on behalf of their members have varying economic implications. The associations of manufacturers have rendered useful services in the standardization of grades and the compilation of trade statistics. Likewise, the associations of dealers have provided technical services and protected the legitimate interests of their constituencies. A major effect, however, of the efforts of these groups has been to check the development of new and more economical methods of distribution. In numerous types of building material manufacture there has been a long history of concerted action to mitigate the severity of the competitive struggle. Among distributors there have been widespread efforts to reach the same objective. These activities tend to become interwoven and to result in a crystallization of the prevailing distributive channels.

Table XVI.—*List of miscellaneous purchases made in 2 selected months by general contractor in building a single-family house* [1]

Dec. 5.	15 barrels cement	$32.25
	Copper wire nails	1.70
8.	Reinforcing rods	6.91
9.	Sixpenny cut finish nails	5.40
	65 pounds eightpenny nails	2.93
	Miscellaneous	1.50
10.	30 bags cement	16.13
	2 steel sash	7.00
	20 bags cement	10.75
11.	100 cubic feet insulation	20.00
12.	Lead, oil, turpentine	9.53
	6 joist hangers	5.30
	5 brushes	1.95
	23 feet lead pipe	8.80
	5 rolls Bermico	6.25
	2 rolls insulating paper	4.50
	35 feet asbestos paper	2.80
	10 pounds roofing cement	1.25
	2 kegs eightpenny common nails	7.60
	1 keg twentypenny nails	3.50
	2 thermometers	1.60
15.	20 feet spruce	1.29
	Pipes and bends for drains	2.67
16.	Lead flashing	.90
17.	Pipe and drain bends	9.33
18.	I roll insulating paper	2.25
	3 rolls Bermico	3.75
	16 lights wire glass	2.58
	12½ pounds putty	.69
	Express	.56
	1 keg eightpenny common nails	4.00
	Paint pot	.25
	Copper flashing	1.88
	Sheet lead	.88
	Coupling	1.43
20.	30 cement blocks	4.20
26.	Wallboard and boards	23.65
30.	Lumber	30.31
	Boards	170.00
Mar. 1.	200 gallons fuel oil	15.00
3.	Lag screws	.52
6.	Nails	8.75
10.	1 brush	.35
	250 gallon fuel oil	18.75
11.	Drawer pulls and bolts	5.65
	7 rolls Bermico	8.75
	Sandpaper	.73
20.	1 light wire glass	.25
23.	1 angle iron	1.50
	2 bags lime	.90
	1 bundle lath	1.12
24.	Miscellaneous	1.97
	7½ barrels cement	16.14
27.	1 push button	2.00
28.	Bermico paper	1.00
	Cesspool grate and ring	7.50
31.	Pipe, bends and cement	19.22
	8 tons blue dust	24.00
	2 sets sash balances	4.28

[1] Source: Bemis, *Economics of Shelter*, vol. II, p. 187.

Many of these activities have been challenged during the history of these associations by various State and Federal authorities. A recent example is a cease and desist order issued by the Federal Trade Commission in December 1937 against the National Federation of Builders' Supply Associations, the membership of which consisted of 41 federated units located in 32 States, and various other dealer associations. Among the practices inhibited by the order were the following:

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[33] New York, Harcourt, Brace & Co., 1932, pp. 52-53.

> Preparing, publishing, and circulating among manufacturers and producers of building materials and builders' supplies lists or directories containing the names of "recognized" dealers, for the purpose or with the effect of indicating that the specified persons or concerns are recognized as entitled to buy direct from said manufacturers and producers, and that other persons, concerns, or classes thereof are not so entitled.
>
> Using boycott, threats of boycott, either with or without other coercive methods, to persuade, induce, or compel manufacturers and producers to refrain from selling building materials and builders' supplies to the so-called irregular dealers, or to others, or to refrain from so selling, except on unfair, discriminatory, or prohibitive terms and condition fixed by respondents.
>
> Cooperating with other dealer organizations and with manufacturers and producers for the purpose of confining sale and distribution of building materials and builders' supplies to so-called regular channels, and preventing their sale and distribution otherwise.
>
> Fixing or establishing uniform prices at which respondent dealer members or others, in particular communities, shall sell their materials and supplies.

Whatever may be the legality of the activities of these trade groups, they undoubtedly introduce rigidities and inflexibilities into the pricing of building materials. To attempt a detailed analysis of these influences or to present a detailed description of the many channels of distribution through which building materials reach the consumer is out of the question. Nor does space permit presenting evidence on the mark-ups, terms of sale, organization of outlets, and the like as they vary between regions, between stores, between building materials, between modes of distribution, between phases of the ups and downs of building, and so on. The nature of these complications can readily be inferred from a few selected facts on lumber.

Distribution of Lumber From Plants

Needless to say, the extraordinary expensiveness of our system of distribution has been fully realized by the manufacturers, retailers, and wholesalers of building materials for a long period of time. Almost every conceivable type of experiment to reduce the spread has been tried or is in operation.

Table XVII illustrates how planing mill operators distributed their product in 1935. Little was sold to their own wholesale branches or to their own retail stores. More than a third was sold directly to industrial and other large users, a fifth to wholesalers and jobbers, a fifth to retailers, and about one-eighth directly to household consumers.

A clue to the handling costs of building materials, exclusive of freight charges, which are incurred between the manufacturer and the retailer is contained in table XVIII. While these figures cover only that portion of lumber and other building materials that is handled by wholesale and industrial distributors, they show nevertheless the character of the cost that is incurred when building materials are put into the hands of the retailers through these channels. Notice that a large share of the total goes to the wholesale group which does between $100,000 and $200,000 worth of business. Those doing over a million dollars worth sell only one-fifth of the total amount reported sold, despite the fact that the ratio of expenses to net sales for the group selling between 1 and 2 million dollars worth of "lumber and millwork" is the lowest of the list, 15.5 percent. On the average, the ratio for "lumber and millwork" is 19.1 percent. In short, about a fifth of the dollar which the wholesaler receives from his customers, i. e., the retailers, goes for expenses. The proportion going into profits is, of course, not included.

Retailing Lumber

But once in the retailer's hands the process of cumulating costs has by no means ended, for retailers of building materials incur the same variety of expense as do retailers of other merchandise, expenses for handling and delivery, for advertising, maintenance and repair of premises, taxes, insurance, and so on. The amount of this expense when translated into mark-up varies with the size and type of business, with merchandising policies, and the like. It differs from time to time in the same store, from item to item, from store to store, and from place to place.

An example of the amazing variation that exists in this regard between geographic areas is given in table XIX. This variation is, of course, quite the ordinary run of affairs and exists in no less striking a fashion between stores in the same city as well as between stores in a metropolitan city and those in the suburbs. Notice that the average mark-up on cost is about 40 percent, although it varies from percentages as high as 60 in certain southern states to figures below 30 percent in South Dakota and the District of Columbia.

Another noteworthy feature is the relatively high amount of interest and bad debts expense, indicating the marked extent to which building materials dealers endeavor to encourage homebuilding by financing the builder and homeowner. The enormous variation in 1934 probably reflects depression conditions, for the percentage on cost of goods sold is less than 2 percent in the Carolinas, Delaware, Vermont, North Dakota, and the District of Columbia and over 10 percent in Idaho, Rhode Island, and Southern New Jersey.

One other fact remains to be observed and emphasized: the magnitude of, and variation in, selling and administrative expense. It is uniformly from one-half to two-thirds of total expense. Its components as reported in the volume from which this table is taken are in order of size: officers' or partners' salaries, 28 per-

TABLE XVII.—*Distribution of sales from plants*

Planing-mill products (including general millwork)[1]

Number of plants,[2] 2,561

Total sales reported, $221,938,000[3]

Channels of primary distribution	1935					1929		
	Amount of net sales (add 000)	Percent total net sales	Percent distributed sales	Number of plants		Percent distributed sales	Number of plants	
				Total	Selling exclusively		Total	Selling exclusively
Total for industry	$221,938	100.0	----------	2,561		----------	3,746	
To own wholesale branches	8,013	3.6	3.9	59	24	7.1	395	144
To industrial and other large users	76,727	34.6	37.5	1,227	577	56.0	2,870	2,030
To wholesalers and jobbers	47,970	21.6	23.4	717	211	36.9	1,469	656
To own retail stores	4,979	2.2	2.4	119	53	(4)	----------	----------
To retailers (including chain stores)	39,360	17.8	19 2	788	198	(4)	----------	----------
To household consumers	27,851	12.5	13.6	962	328	(4)	----------	----------
Total distributed sales	204,900	92.3	100.0	----------	----------	100.0	----------	----------
Transfer to other plants in own organization	5,051	2.3	----------	61	25	No comparable information is available for 1929 on these items.		
Sales not allocated to usual channels	11,987	5.4	----------	189	147			
Sales negotiated through agents, brokers, and commission houses	13,509	6.1	----------	194	29			

[1] Source: *Census of Business, 1935; Distribution of Manufacturer's Sales*, p. 96.

[2] The plants in this classification are "independent" planing mills; that is, planing mills not operated in conjunction with sawmills. (Planing mills operated in conjunction with sawmills are classified in the "Lumber and timber products" industry.) Principal products are dressed lumber, sash, doors, frames, interior woodwork, and molding. The *Census of Manufactures* reports a preliminary value of products for this industry of $196,272,000 in 1935.

[3] Includes $17,098,000 purchased merchandise sold without processing and $571,000 received for processing materials owned by others.

[4] Sales to household consumers were combined with sales to industrial users; sales to retailers were combined with sales to wholesalers; and sales to own retail stores were combined with sales to own wholesale branches, all because of incomplete reports.

TABLE XVIII.—*Sales and expenses of wholesale merchants and industrial distributors of lumber and construction materials by business size groups*[1]

Kind of business	Total, all establishments				Establishments with sales of—															
					Under $10,000				$10,000 to $49,999				$50,000 to $99,999				$100,000 to $199,999			
	No.	Net sales (add 000)	Expenses (add 000)	Expenses percent to sales	No.	Net sales (add 000)	Expenses (add 000)	Expenses, percent to sales	No.	Net sales (add 000)	Expenses (add 000)	Expenses, percent to sales	No.	Net sales (add 000)	Expenses (add 000)	Expenses, percent to sales	No.	Net sales (add 000)	Expenses (add 000)	Expenses, percent to sales
Lumber and construction materials	2,263	$338,949	$69,902	20.6	191	$906	$310	34.2	692	$19,333	$5,124	26.5	470	$33,446	$7,905	23.6	461	$66,875	$15,182	22.7
Builders' supplies (full line)	503	74,442	16,025	21.5	26	119	35	29.4	152	4,539	1,095	24.1	113	8,379	1,742	20.8	107	15,429	3,106	20.1
Lumber and millwork	1,082	190,342	36,376	19.1	75	349	113	32.4	288	8,176	2,044	25.0	213	15,103	3,383	22.4	242	35,784	7,802	21.8
Brick, tile, and terra cotta	112	8,309	1,806	21.7	9	36	7	19.4	47	1,261	292	23.2	29	2,094	494	23.6	17	2,157	484	22.4
Cement, lime, and plaster	123	18,374	3,358	18.3	9	47	20	42.6	40	1,290	298	23.1	26	1,747	359	20.5	27	4,165	877	21.1
Glass	258	21,544	6,653	30.9	42	203	73	36.0	105	2,452	861	35.1	46	3,206	1,190	37.1	41	5,604	1,898	33.9
Sand, gravel, and crushed stone	96	9,575	2,770	28.9	17	90	36	40.0	31	832	285	34.3	20	1,409	423	30.0	13	1,774	546	30.8
All other	89	16,363	2,914	17.8	13	62	26	41.9	29	783	249	31.8	23	1,508	314	20.8	14	1,962	469	23.9

Kind of business	Establishments with sales of—																			
	$200,000 to $299,999				$300,000 to $499,999				$500,000 to $999,999				$1,000,000 to $1,999,999				$2,000,000 and over			
	No.	Net sales (add 000)	Expenses (add 000)	Expenses, percent to sales	No.	Net sales (add 000)	Expenses (add 000)	Expenses, percent to sales	No.	Net sales (add 000)	Expenses (add 000)	Expenses, percent to sales	No.	Net sales (add 000)	Expenses (add 000)	Expenses, percent to sales	No.	Net sales (add 000)	Expenses (add 000)	Expenses, percent to sales
Lumber and construction materials	191	$46,330	$9,450	20.4	140	$53,043	$10 481	19.8	81	$52,504	$9.509	18.1	29	$40,521	$6,262	15.5	8	$25,991	$5,679	21.8
Builders' supplies (full line)	52	12,563	2,503	19.9	35	13,497	2.643	19.6	12	7,969	1,531	19.2	4	(2)	(2)	(2)	2	(2)	(2)	(2)
Lumber and millwork	105	25,554	4,980	19.5	81	30,768	5,532	18.0	53	33,394	5,783	17.3	20	27,204	3,967	14.6	5	14,010	2,772	19.8
Brick, tile, and terra cotta	8	1,999	369	18.5	2	(2)	(2)	(2)	----	--------	-------	-------	----	--------	-------	-------	----	--------	-------	-------
Cement, lime, and plaster	8	1,828	396	21.7	6	2,027	336	16.6	4	2,563	439	17.1	3	4,707	633	13.4	----	--------	-------	-------
Glass	10	2,448	724	29.6	7	2,628	789	30.0	7	5,003	1,118	22.3	----	--------	-------	-------	----	--------	-------	-------
Sand, gravel, and crushed stone	6	1,431	405	28.3	7	2,679	743	27.7	2	1,360	332	24.4	----	--------	-------	-------	----	--------	-------	-------
All other	2	507	73	14.4	2	(2)	(2)	(2)	3	2,215	306	13.8	2	(2)	(2)	(2)	1	(2)	(2)	(2)

[1] Source: *Census of Business, Wholesale Distribution, 1935*, v. 1, p. 88.

[2] Withheld to avoid disclosure of individual operations.

cent of the total for this item; office wages, 20 percent; salesmen's salaries, commissions, and travel, 13 percent; insurance, 10 percent; taxes, 5 percent; rent, 4 percent; advertising, 3 percent; postage, telephone, heat, accounting fees, legal fees, donations, office maintenance, etc., 17 percent.

On the whole, losses tend to occur wherever selling and administrative expenses are high (Rhode Island,

TABLE XIX.—*Profits and expenses, retail lumber dealers, 1934* [1]

[Known dealers, 23,531. Dealers reporting, 3,554]

State	Sales volume, 000 omitted	Percentage of each to total cost of goods sold						
		Gross mark-up realized	Re-work mill expense	Handling delivery expense	Selling and administration expense	Interest and bad debts expense	Total expense	Profit or loss (−)
United States	$166,763	38.39	1.04	9.85	23.64	4.53	39.06	−0.67
Alabama	1,409	53.87	5.93	12.37	26.43	4.92	49.65	4.22
Northern California	2,426	37.80	1.41	9.80	20.38	4.38	35.97	1.83
Carolinas	107	60.21	9.45	12.53	32.87	1.89	56.74	3.47
Florida	6,068	41.56	1.53	9.59	20.64	4.49	36.25	5.31
Georgia	1,786	39.49	3.13	10.49	19.28	2.69	35.59	3.90
Illinois	3,871	37.86	.17	9.89	23.29	4.43	37.78	.08
Indiana	6,307	38.47	.73	9.22	24.42	4.65	39.02	−.55
Kentucky	1,842	45.11	1.09	10.14	28.27	4.57	44.07	1.04
Louisiana	1,630	37.32	.15	9.84	22.97	2.13	35.09	2.23
Southern Michigan	6,099	38.87	.96	11.06	22.93	4.41	39.36	−.49
Delaware	548	40.58	------	10.21	21.06	1.75	33.02	7.56
District of Columbia	193	27.12	------	6.87	10.95	1.63	19.45	7.67
Maryland	1,827	38.23	1.25	9.61	21.88	3.98	36.72	1.15
Southern New Jersey	1,282	38.91	1.16	11.79	30.65	14.32	57.92	−19.01
Eastern Pennsylvania	9,030	39.31	.84	12.35	23.04	4.11	40.34	−1.03
Mississippi	551	44.46	.08	10.73	30.70	7.27	48.78	−4.32
Colorado	3,435	32.74	.16	7.72	20.99	3.02	31.89	.85
New Mexico	813	35.05	.16	5.43	21.63	3.48	30.70	4.35
Wyoming	823	44.54	------	6.85	26.75	6.66	40.26	4.28
Nebraska	3,784	30.35	.01	7.80	20.84	2.84	31.49	−1.14
Northern New Jersey	3,111	48.01	.57	14.73	31.42	5.39	52.11	−4.10
New York City	3,914	46.29	.96	16.29	27.80	3.95	49.00	−2.71
Connecticut	4,985	41.64	.07	12.71	22.45	6.20	41.43	.21
Maine	661	43.40	3.60	8.09	23.18	3.82	38.69	4.71
Massachusetts	6,349	41.26	1.71	13.78	24.73	4.46	44.68	−3.42
New Hampshire	405	48.59	7.73	15.08	22.01	5.08	49.90	−1.31
New York State	9,349	39.78	1.23	10.95	25.21	4.84	42.23	−2.45
Pennsylvania, part	183	52.88	13.19	9.12	16.82	7.14	46.27	6.61
Rhode Island	883	45.97	.95	14.37	35.47	12.09	62.88	−16.91
Vermont	353	46.24	2.45	7.13	31.17	1.43	42.18	4.06
Iowa	3,689	31.75	------	9.74	15.62	2.55	27.91	3.84
Minnesota	2,538	33.11	------	9.14	17.96	3.55	30.65	2.46
North Dakota	1,381	33.43	------	4.43	24.40	1.26	30.09	3.34
South Dakota	1,047	28.81	------	3.33	24.59	2.88	30.80	−1.99
Ohio	10,590	44.21	1.53	11.07	26.89	5.62	45.11	−.90
Western Pennsylvania	4,268	42.08	1.36	10.76	27.45	5.80	45.37	−3.29
Arkansas	167	38.92	------	11.99	20.06	6.29	38.34	.58
Kansas	3,013	37.74	.01	5.50	25.87	4.41	35.79	1.95
Missouri	5,039	34.47	.43	6.65	22.75	3.04	32.87	1.60
Oklahoma	5,354	33.74	------	4.42	22.91	4.37	31.70	2.04
Tennessee	1,275	43.78	1.28	8.91	29.04	4.64	43.87	−.09
Texas	6,914	38.10	.25	3.14	27.27	4.69	35.35	2.75
Utah	551	32.48	.55	7.78	18.27	6.54	33.14	−.66
Virginia	3,293	37.46	2.97	9.69	20.93	3.78	37.37	.09
Idaho	280	37.10	------	6.35	18.44	13.64	38.43	−1.33
Montana	2,078	41.48	.44	9.29	21.59	6.93	38.25	3.23
Nevada	96	37.03	------	7.27	28.84	3.28	39.39	−2.36
Oregon	633	47.38	.03	9.34	29.95	3.74	43.06	4.32
Washington	1,917	43.06	.92	13.41	23.52	5.11	42.96	.10
West Virginia	1,001	38.14	1.05	9.33	20.71	6.30	37.39	.75
Northern Michigan	210	35.43	------	10.95	16.49	2.86	30.30	5.13
Wisconsin	8,931	32.49	.29	8.81	19.00	4.05	32.15	.34
Cook County, Ill	3,509	42.15	.35	11.61	29.13	4.92	46.01	−3.86
St. Louis County	1,855	45.07	2.66	10.81	31.19	3.02	50.68	−5.61
Arizona	2,535	38.84	.01	10.75	24.03	4.35	39.14	−.30
Southern California	10,547	30.20	3.12	9.98	21.26	4.64	39.00	−8.20

[1] Source: Arranged from Table XLIX, *Economic Problems of the Lumber and Timber Products Industry*, National Recovery Administration, Industrial Studies Section, March 1936, p. 320 (mimeo).

N. and S. New Jersey, Mississippi, St. Louis County). *Per contra*, regions with a low selling and administrative figure tend to show the highest percentage of net profit. (Florida, District of Columbia, Delaware, part of Pennsylvania, Iowa, N. Michigan.) None the less, despite the relatively large mark-up, notice that on balance lumber dealers as a whole lost money in 1934. In a nutshell, the distributive lumber problem consists of large price spreads, hordes of dealers, enormous duplication of selling and administrative expense, and small net profits, if any.

In table XX is presented a vertical cross section of the lumber industry from stump to consumer. While it applies to a particular market, New York, for a particular period of time, for particular kinds of lumber sold direct from mill to retailer, it gives an approximate picture of general conditions and suggests the numerous possibilities of variation. Cost to the consumer is in every case over twice total mill cost.

TABLE XX.—*Lumber cost at New York, N. Y., code period January to March 1934* [1]

	Douglas fir water	Douglas fir	Southern pine	Western pine	Oak
Shipping weight per M feet (pounds)	3,100	2,800	3,000	2,300	4,300
Freight rate per 100 pounds	-------	$0.87	$0.37	$0.73	$0.41½
Costs per M. B. M.:					
Stumpage	$2.42	2.42	4.31	2.11	6.31
Logging and milling:					
Labor	5.11	5.11	7.58	6.35	9.27
Other costs	6.58	6.58	6.13	7.77	6.91
Shipping and selling:					
Labor	1.06	1.06	1.61	1.90	2.35
Other costs	1.21	1.21	1 07	1.95	1.53
Overhead and administrative:					
Officers and owners pay	.62	.62	1.05	.76	4.11
Other costs	1.80	1.80	3.50	2.60	-------
Total mill cost [2]	18.80	18.80	25.25	23.44	30.48
Freight	10.20	24.36	11.10	16.79	17.75
Cost to retailer	29.00	43.16	36.35	40.23	48.33
Retail costs: [3]					
Labor	6.51	9.69	18.16	9.08	10.83
Officers and owners pay	1.77	2.64	2.22	2.46	2.95
Other costs	5.96	8.88	7.48	8.28	9.94
Total cost to consumer	43 24	64.37	54.21	60.00	71.95
Recapitulation:					
Stumpage	2.42	2.42	4.31	2.11	6.31
Logging and milling	11.69	11 69	13.71	14.12	16.18
Selling and administrative	4.69	4.69	7.23	7.21	7.99
Freight	10.20	24.36	11.10	16.79	17.75
Retailers costs	14.24	21.21	17.86	19.77	23 72
Total cost to consumer	43.24	64.37	54.21	60.00	71.95

[1] Source: *Economic Problems of the Lumber and Timber Products Industry.* National Recovery Administration, Industries Studies Section, March, 1936, p. 323 (mimeo.).
[2] Total mill costs derived from industry cost questionnaires.
[3] Retail costs derived from industry cost questionnaires.

Notice particularly that logging and mill labor, even under National Recovery Administration regulations, in no case got more than 15 cents of the consumer dollar, and in the case of West Coast labor, 12 cents. The railroads generally got twice that amount and the retailer usually more than the railroad. In fact, if logging and sawmill laborers' National Recovery Administration wages had been halved, the reduction in the price to the consumer, even if passed on 100 percent, would be less than 7 percent and usually fail to exceed 6 percent.

There is no assumption in the analysis given above of a parallel trend, constant spread, or continuously identical or proportional relationships between the prices of labor plus other production costs of building materials on one hand, and wholesale prices, retail prices, building costs, and selling prices of houses to consumers on the other. Obviously such an assumption would not fit the facts. Each of these sets of prices is subject to special influences and special market conditions. The prices of houses to homeowners bear little, if any, fixed relationship to reproduction costs of the structure, since factors like style of house, local population pressures and movements, and general business conditions[34] are more important.

Similarly building costs correspond but loosely with local retail prices of building materials, for not only do types of materials used depend somewhat on changing consumer fancy but the quantity absorbed varies with price and technological progress. Retail prices of building materials, like those of commodities in general, follow wholesale prices only sluggishly, depending to a large extent on local distributor competition.

As has been shown above, changes in building materials wholesale prices, like those of wholesale prices in general, take place for a variety of special monetary, financial, and even political reasons wholly dissociated with changes in wage rates or in other direct costs. Numerous interstitial price shifts take place vertically within the industry and geographically between uses and users, types of outlets, and modes of distribution.

In sum, the prices of building materials cannot be understood by adding together the "costs" at various points along the stream from the original producer to the consumer. The maze into which one finds himself drawn in the attempt to understand them cannot be threaded by any simple analysis. Even extended experience with these prices leaves the student in a quandary. The attempt to bring prices to levels which will mean lower costs of construction calls for a many-sided attack.

How Can the Cost of Building Materials Be Reduced?

To reduce the cost of building materials and equipment in order to secure more housing requires activities of several kinds, (1) those tending to increase the efficiency of production and distribution and thus lower the prices of building materials, (2) those designed to encourage a high degree of competition within the materials industries, and (3) those which bring about maximum economy in assembly at the site and incidentally economies in the purchase of materials.

Business and governmental efforts towards getting more materials at lower prices will, of course, vary with the particular industry concerned, but they fortunately need concern only a handful of such industries. As was noted above most of the construction dollar goes for four or five items—lumber, steel, brick, cement, and heating and plumbing equipment. The materials problem so far as manufacture is concerned is mainly concentrated in the industrial areas covered by the lumber, steel, brick, and cement industries.

A complete program of action would, of course, require tackling each problem individually after careful investigation and consultation with the trade associations and leading producers in each field. In the lumber industry certain forces were at work late in 1937 causing stocks to accumulate, a development which brought further declines in lumber prices; but no such promise of relaxation of the grip of collectivistic restrictive activity of business exists in the other industries. Steel and cement have for years operated on a basing point system for the control of prices. Both are produced by large scale production methods and controlled by gigantic aggregates of capital.

It is fairly obvious that the individual consumer has available no ready means of obtaining lower prices of materials. There are, however, governmental devices which can be used if the aim of government policy were solely to reduce prices. Modification of tariff schedules might be influential in some cases. Another device which is available is the more rigid enforcement of the antitrust laws. Difficulties exist in breaking up collusive practices even where they are known to constitute effective economic monopoly or where they introduce rigidities into the mechanism for making prices. However, many of the agreements and trade practices are so woven into the business structure that only industrial reorganization will make any real difference.

A third device open to the consumer is that of utilizing to the full his own bargaining power, particularly insofar as it is concentrated in the purchases by cities, counties, States, and national governments. Stronger units might help weaker units, putting in a competitive bid to supply neighboring local governments at reasonable prices. Governmental purchasing agents could co-ordinate their purchases and concentrate the bargaining power inherent in large-scale buying, operating in the same manner, for example, as does the bargaining power of the large automobile concerns to secure concessions from the steel industry.

Policies of public buying should be critically reexamined. It might be true, for example, that instead of trying to secure bids on individual contracts, cities and other governmental units might initiate a well-known practice of certain highly successful chain stores and small mail order houses; namely, contract to take all of an individual's output for a period of years. If governmental agencies find that even this inducement is insufficient to establish competition between individual producers, it is theoretically possible to follow sound business and corporate practice by producing their own materials. Many large American business units, both manufacturers and distributors, find such cost control necessary to guarantee adequate supplies of raw materials at reasonable prices. Municipal purchasing agents have demonstrated the method of combined purchasing City fire departments manufacture parts of their own equipment. The Federal Government has let independent contracts where evidence of collusive bidding could be shown.

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[34] See Frank R. Oarfield and William M. Hoad, "Construction Costs and Real Property Values," *Journal of the American Statistical Association*, December 1937, vol. 32, No. 200, pp. 643–54.

Many other devices will suggest themselves as detailed examination is made of the individual industries—devices such as changes in tax policies, reduction or readjustment of freight charges, manufacture and distribution of building materials for low-cost houses by relief labor, reduction of wholesale and retail expenses by factory-to-site operations, and the like.

To rest on the demand for more competition is, however, considerably to oversimplify the problem. Much of the combination and collusion which have developed in the industry have come directly from the character of the building industry. In its distributive phases the industry consists of a multitude of competing units which compound the expenses of competition and overlook the efficiencies of better organization. Large-scale operations in themselves do not make for efficiency, and even when efficient they may develop antisocial practices. But the organization of the distribution of materials so as to bring about efficient purchasing will probably only come when large-scale operations in building homes are actually undertaken. For this reason, we turn to a brief discussion of the savings in material costs which can be achieved through large-scale construction operations.

Handicraft Character of House Building

High as some prices are, houses could be built more cheaply if the process of assembly were less disorganized. At present, the job of putting up a house is one of assembling hundreds of parts, including many which are ordered to specifications. It involves numerous operations, requires a score of individual skills or trades, and utilizes several hundred items of equipment, varying from transits to concrete mixers. Usually a dozen or more separate contracts must be negotiated. On nearly every job is found a group of sub-subcontractors whose accounting methods are rudimentary. Each bidder figures the cost of materials, adds on a percentage for waste, incurs the overhead of running from job to job for labor and equipment, and adds a profit which is as much as he thinks he can get considering the bid of his competitors and the shrewdness or bargaining leverage of the contractor or purchaser.

The need for integrating such various activities has long been felt. Almost universally there have grown up local tie-ups, reciprocity arrangements between contractors and building materials dealers, between architects, building supply houses, and building and loan associations or banks, and between contractors and labor organizations. Local pressure is often utilized to keep the contracts in the community, particularly where local dealers or contractors have perfected arrangements for dividing the local market between them.

Contractors who know their subcontractors and who have semipermanent arrangements with them add an element of efficiency to the building operation which can otherwise be achieved only by corporate integration or large-scale operators. Competitive bidding contains large elements of waste. Duplicate designing of slipshod character, collusive bidding within narrowly-agreed ranges, cleared bids dominated by an association, overhead for contracts not received are all expensive. They account to some extent for irregular operation and high overhead as well as high labor costs.

Existing organizations always tend to oppose change. Accepted methods are the easiest to use. When they seem to react to the financial advantage of all concerned it would be strange to find any other attitude. Nor is it strange to find that those who have investment in high-cost construction lack interest in lower reproduction costs.

With so many powerful forces opposed to change, the traditional method of building tailor-made homes has experienced little change or improvement. Use of labor-saving devices is the exception. Often contractors recruit laborers for each job and operate on such slender resources that they even lack the capital to take advantage of quantity and cash discounts. Materials are dumped on the site and fitted by the "cut-try-and-cut-again" procedure. There are few operative builders able to put up a block or row of houses, this type of construction accounting even in 1929 for only 2 percent of the total value of residences built. Most building is done by small contractors, as table XXI indicates. The small volume of business done, the small number of employees per establishment, and the meager amounts of materials installed by the firms contained in this sample depict the small retail character of the business.

TABLE XXI.—*Building contractors in 1935* [1]

Type of contractor	Number of establishments		Value of work performed		Employees (average per year)		Cost of materials installed	
	Total	In this sample	Total (add 000)	Average per firm	Total	Average per firm	Total (add 000)	Average per firm
General building	8,337	7,139	$352,329	$49,000	105,302	14.7	$162,641	$22,800
Carpentering	7,853	5,698	25,129	4,400	6,038	1.1	9,677	1,700
Concreting	981	869	10,465	12,000	3,609	4.1	4,383	5,000
Electrical	8,473	3,413	70,371	21,000	16,299	4.8	28,997	8,500
Excavating and/or foundation	375	342	11,716	34,000	3,938	11.5	2,478	7,200
Glass and glazing	141	86	1,851	21,000	404	4.7	756	8,800
Heating and plumbing	23,856	13,741	214,642	15,800	45,752	3.3	103,005	7,500
Roofing and sheet metal	5,927	2,889	47,844	16,500	12,209	4.2	20,836	7,200
Masonry	1,288	823	10,203	12,000	2,996	3.6	3,980	4,800
Ornamental iron	158	145	1,369	9,400	316	2.2	618	4,300
Painting, paperhanging, decorating	11,078	6,186	38,605	6,200	12,394	2.0	9,464	1,500
Plastering	899	720	9,476	13,000	3,180	4.4	3,261	4,500
Tile and mantel	891	665	13,686	20,600	3,793	5.7	6,478	9,700
Wrecking and demolition	129	108	2,325	21,000	931	8.6	124	1,100

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[1] Source: Data are taken or computed from the *Census of Business, Construction Industry: 1935*, table 2, vol. 1, p. 45. Figure for total number of firms, *ibid.*, table 1, vol. 1, p. 1.

Are There Economies in Large Scale Operations?

This suggests, in conclusion, possibly one of the most promising ways of reducing the high cost of building materials; namely that of large scale building through which can be realized the economies of large order purchasing and transportation of materials, and of central planning and control of development. The experience of a few such large scale operations may well be worth describing.

According to President N. M. Ruben of a Chicago appraisal company, as quoted in the *Architectural Forum* for August 1937, a saving of 13 percent can be realized in a development of only 10 houses. He took bids from Chicago subcontractors on a two-story colonial brick veneer home complete with winter air conditioning, and on the same house built 10 times over. His comparative figures are based on actual plans and specifications and on the bids received from the subcontractors approached.

Significant deductions from Appraiser Ruben's comparative figures:

> The pipe trades—heating, ventilating, and plumbing—are fields showing relatively slight differentials.
>
> Plastering likewise is a trade in which the operative builder can effect only a slight saving, and then only if he is a shrewd buyer.
>
> Greatest savings can be marked up in the shell of the building. Concrete, masonry, and lumber—those items over which the general contractor has chief control—are all fields where bulk purchase of materials and a large covering contract will reduce costs.
>
> Carpentry and millwork, embracing staircases, provide another category where savings can be effected.
>
> The obvious corollary to Appraiser Ruben's comparison is that multiplying his base house by 10 is not enough to effect as appreciable savings as with a larger project. Thus the roofing contractor might well have figured that his reduction in materials for 10 houses would be offset by the spasmodic use of his labor.
>
> Bids received on the most important items entering into Appraiser Ruben's hypothetical house are listed under "Individual Buying." Average costs for the same structure duplicated 10 times are listed under "Operative Buying." [35]

The article gives the following tabulation which well merits detailed study:

	Individual buying	*Operative buying*
Excavation, backfill, grading	$250	$250
Foundations, dampproofing	750	680
Structural steel	50	50
Masonry walls	1, 030	950
Carpentry, including millwork, hardware, insulation, and stairs	2, 978	2, 429
Plastering	710	615
Sheet metal	80	70
Roofing	125	125
Tile	145	145
Painting and decorating	650	535
Glass and glazing	70	70
Plumbing, sewerage, gas fitting	850	760
Heating, air conditioning	$685	$600
Electric wiring, service	232	174
Electric fixtures	75	75
Calking, weatherstrips	45	35
Shades and blinds	25	25
Linoleum	75	75
Building permit	52	52
Total	$8, 877	$7, 715

Again, the firm, American Houses, Inc., has found in putting up their new plywood asbestos shingle houses (prefabricated) that the cost of structure for building a single house was $1,356.64 and for numbers of houses was $1,249.66, or $107 less, of which $27 represented saving in excavation and $40 represented saving in laying foundations.

Another indication of the economies of large-scale operations is the fact that the Westacres project at Pontiac, Mich., built more than 150 houses of roughly the same type as Purdue University's house No. 1, the former at a cost of structure of $3,477.48, the latter at a cost of structure of $4,852.45, a difference of nearly 40 percent. While not precisely comparable, the differences in these costs are significant.

A final bit of evidence on this point should be cited, the Meadville, Pa., project where in 1936 a wooded hillside was transformed into a community of 202 houses in 8 months. The Federal Housing Administration insured a 4-percent loan of $1,012,000 amortizable in 30 years. "Corporation officials estimate that the houses built under this plan cost 25 percent less than individually-built houses of comparable size and quality." [36]

Large-scale operations, however, require not only a far larger investment per contractor than the industry now has. They also require the ability to operate on one tract or in one neighborhood. Otherwise, difficulties in supervision and organization cause increases in overhead which more than offset other savings.[37]

Some Examples of Vertically-Organized Building Operations [38]

At present in the United States it seems that genuinely low-cost housing can only be built by special groups of persons. Trailer manufacturers are providing accommodations for hundreds of thousands of families in mobile houses. Cottage camps and auto courts have provided inexpensive and moderately comfortable accommodations for tourists. Many industrial firms have built good but inexpensive company houses for their workers. The Newport News Shipbuilding &

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[35] *Architectural Forum*, August 1937, vol. 67, No. 2, p. 54.

[36] "The Construction Industry Yearbook," 1937 edition, published by the *Engineering News Record*, p. 79.

[37] In Great Britain large firms build houses in groups of 50 or 100 in about 10 weeks, the house selling for about $2,250 and the land costing about $275. One such firm was recently building simultaneously in 21 communities, and proudly boasted that in less than 10 years it had marketed 30,000 houses.

[38] For a parallel discussion, see section on "The Significance of Small-House Design," pp. 47–49.

Drydock Corporation recently completed 75 two- and three-bedroom frame houses for its Negro laborers at a cost completely furnished of only $2,400. The two prefabricating companies of the American Rolling Mills Co. have built 300 houses, and General Houses, Inc., has built about 40.

Other examples can be cited, such as the Westacres project at Pontiac, Mich., which has been mentioned previously in this discussion. It constructed two-story houses with an acre of land for $4,439. Still another development is that of the Gross Morton project, Long Island, where 232 of a projected 1,000 1½-story houses have been built at a cost of $5,298 each. Another example is that of Colonial Garden Homes, Long Island, which consists of a house 26 by 36 feet plus a garage on a lot 53 feet by 100 feet, all for $3,000. The development producing the cheapest house is that of Realty Associates, Inc., on Long Island who provide 4-room frame cottages on lots 43 feet by 100 feet for $2,500.[39]

These illustrations give an idea of the fact that low-cost houses can be built. Study of their cost indicates that savings can be made in buying materials. These savings can be supplemented by better organization on the site. Furthermore, such changes in industrial organization are gradually demonstrating their practicability. They will, of course, be fought by those attached to the older ways of building.

The process of obtaining a reduction in the high prices of building materials, of lowering freight charges, of reducing distributive margins, and of integrating the various craft operations on the site is beset with difficulties. Rationalization will be slow. But there are indications that it is making headway.

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[39] It should not be assumed that these prices are for houses of the same quality. Likewise, the question of cost is a matter of the character of financing and the length of life of the house and the community. These factors are discussed elsewhere in this series.

V. LABOR AND THE COST OF HOUSING[1]

By Mercer G. Evans[2]

Available data indicate that wage rates of building-trade workers viewed in terms of national earnings are not out of line with wage rates of workers in comparable lines of employment. Shortages of labor have occurred only in relatively few crafts involving highly skilled workers. Lower labor costs are probable only with guaranties of more full-time employment. Vertical integration is one possible method of achieving this end. An additional method is through the regularization of Government building operations.

Introduction and Summary

Recent discussions have tended to emphasize the high price of construction labor as one of the principal factors retarding the development of adequate housing facilities for families in the lower income groups. An examination of available data indicates that wage rates of building trades workers, when viewed in terms of their annual earnings, or when compared to the wage rates of similarly skilled workers in manufacturing industries, are not out of line with the wage rates of workers in other lines of employment. On the other hand, a review of the organization and operations of the construction industry discloses conditions responsible for higher unit labor costs than would be necessary if the industry could be established on a more stable basis and could provide greater continuity of employment and greater income security. With regard to the immediate future, however, it appears that the achievement of any major economies in labor costs will result from better organization both of the industrial relations and the management of labor on the building job. Such development can be encouraged by the type of practice which the Government might cultivate on projects under its direction. Private builders interested in better management have also demonstrated some of the possibilities which lie in this field.

Relationship of Labor Costs to Total Construction Costs

Data concerning labor-cost ratios in the building industry are limited. The information that is available, however, indicates that direct labor costs of private and public house builders range from 25 to 60 percent of direct construction costs.[3] The ratios were higher for large-scale housing projects undertaken or financed by the Government than for small-scale operations of private builders. These large-scale undertakings provided possibilities of economies in materials purchases that could not be equaled in the utilization of labor. Governmental influence, furthermore, especially because of the provisions of the antikickback statute, caused actual hourly wage payments to be higher than was the case in certain private undertakings. The labor-cost ratios, also, were higher on government projects erected by force-account methods[4] than on government projects erected by contract. On most of these force-account projects, however, certain conditions of relief employment had to be observed. This resulted, in many cases, in the employment of surplus workers, the use of hand methods instead of machine methods, staggered crews employed for varying short periods of time, and, to a degree, the employment of less qualified workmen.

The available data do not reveal a significant correlation between hourly wage payments and labor-cost ratios. This was not unexpected, for other evidence appears to indicate that in many instances higher wages have enabled builders to secure more efficient workers; and higher wages, also, have tended to inspire more efficient management of labor, and to encourage the utilization of more effective mechanical aids.[5] The wide range of relationships between hourly wage payments and labor-cost ratios, both with regard to all of the data available and with regard to the data as segregated for the several conditions indicated in the accompanying tables, points to other factors which are more significant than hourly wage rates in determining labor-cost ratios in the house construction industry.

Wages and Earnings of Building Trades Workers

It is frequently assumed that the construction industry, with regard to labor-cost ratios and rates of wages, stands out in marked contrast to other industries. It is important to know, however, what values are being compared when the rates of pay and labor-cost ratios of the construction industry are contrasted with similar figures of other industries. An industry with an overwhelming proportion of unskilled labor will naturally have a much lower average hourly rate for all workers than an industry where the labor force is primarily composed of highly skilled men. Similarly, the labor-cost ratio in the construction industry may be high when compared with that in a mass production industry with a continuous, unidirectional flow of output, but it may not be high when compared with industries where the productive processes have not been transferred to automatic or semiautomatic machines and where operations depend on highly skilled personnel.

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[1] This report will be limited to the consideration of direct labor costs, as indirect labor costs appear in the costs of material. It might be pointed out, however, that stabilization of construction activities, as well as standardization of the materials used, should effect economies in the utilization of labor as well as capital investments in the manufacture of materials. Large-scale operations in the construction of houses has already indicated that material costs can be substantially reduced when orders can be placed on a large-scale basis. If housing activities in general were regularized, these economies should be several times multiplied.

[2] Dr. Mercer G. Evans is Director, Labor Relations Division, Farm Security Administration (Resettlement Administration), Department of Agriculture. Mr. Evans was assisted in his analysis by Dr. N. G. Silvermaster, senior economist of his staff.

[3] "Construction costs," as used in this chapter, will refer only to costs of materials plus cost of direct labor; "labor costs" will refer only to the wages paid to foremen and manual workers on the job site. "Labor-cost ratio" is used to refer to the percentage which "labor cost" is of "construction cost."

[4] "Force account" refers to construction carried on by the Government as contrasted with work done by contract.

[5] These paragraphs are based on the figures presented in tables I, II, III, and IV.

TABLE I.—*Labor-cost ratios and average hourly wage payments, Federal housing projects* [1]

Project	Average hourly earnings	Labor-cost ratio [2]
District of Columbia, Alley Dwelling Authority, row houses, 1936	$1.100	49.1
Atlanta, Ga., Teebwood Apartments, P. W. A. 1935–36	.707	37.0
Miami, Fla., Liberty Square houses, P. W. A., 1936	.686	43.8
Montgomery, Ala., Paterson Courts, P. W. A., 1935–36	.663	40.8
Montgomery, Ala., Riverside Heights, P. W. A., 1935–36	.658	41.1
Cleveland, Ohio, Cedar Central Apartments, P. W. A., 1935–37	1.119	47.7
New York City, Knickerbocker Apartments, R. F. C. funds, 1933–34	1.148	43.4

[1] Source: Bureau of Labor Statistics.
[2] Stated in percentages of total construction costs chargeable to labor at the site.

TABLE II.—*Labor-cost ratios and average hourly wage payments: averages of 13 cities, representative buildings, 1932*

Project	Average hourly earnings[1]	Labor cost ratio [2]
Atlanta, Ga	$0.658	29.9
Boston, Mass	1.062	43.1
Chicago, Ill	1.234	34.9
Dallas, Tex	.673	26.0
Duluth, Minn	.739	33.7
Indianapolis, Ind	.874	40.3
Little Rock, Ark	.574	32.3
New Orleans, La	.568	30.6
New York, N. Y	1.199	40.4
St. Louis, Mo	1.084	37.0
Salt Lake City, Utah	.863	34.4
Seattle, Wash	1.052	42.5
Trenton, N. J	.833	41.0

[1] These are average hourly wage payments, union and nonunion, as reported in 1936–37. It is believed that they are fairly proportionate in most cases to actual wage payments in these cities in 1932.
[2] Reported in *Monthly Labor Review*, October 1932, p. 764. "Labor-cost ratio" indicated in percentages of total construction cost chargeable to labor at the site.

TABLE III.—*Labor-cost ratios and hourly wage payments, Resettlement Administration, 13 projects, 1935–37* [1]

Project	Average hourly earnings [2]	Labor-cost ratio [3]
Great Falls, Mont., frame	$1.112	61.5
Hightstown, N. J., cement block	.825	55.1
Malta, Mont., frame	.788	61.6
Alamosa, Colo., adobe	.775	63.1
Duluth, Minn., frame	.751	55.0
Phoenix, Ariz., adobe	.717	[4] 54.9
Phoenix, Ariz., frame	.716	[4] 63.5
Birmingham, Ala., frame	.675	53.9
Ironwood, Mich., frame	.642	60.5
Wichita Valley, Tex., frame	.606	[4] 49.6
Newport News, Va., brick veneer	.514	57.7
Pine Bluff, Ark., frame	.500	[5] 48.6
Penderlea, N. C., frame	.483	57.0

[1] Compiled by the Labor Relations Division, Farm Security Administration.
[2] Based on all project wage payments, including large amounts of outside development work, road building, sewer and water mains, land clearing, ditching and landscaping, and including community buildings and other community appurtenances. In most cases, however, these figures are believed to be proportionately lower than corresponding figures on house construction only.
[3] Based on house construction alone. Ratio stated in percentages of total construction cost chargeable to labor at the site.
[4] These houses not equipped with heating systems.
[5] These houses not wired or equipped with inside toilets or heating systems.

The relatively high labor-cost ratio in the construction industry is not unique, as on first glance it appears to be, for an analysis of the *Census of Manufactures* for 1929 shows that a number of major industries have as high or even higher ratios of labor cost than that found in the construction industry. Thus, the *Census of Manufactures* lists 16 major manufacturing groups, 5 of which have labor-cost ratios ranging from 37.7 to 53.7 percent. Of these, the printing, publishing, and allied industries have a labor-cost ratio of 45.4 percent; stone, clay, and glass products, 45.2 percent; machinery, not including transportation equipment, 37.7 percent; forest products 38.2 percent; and railroad repair shops 53.7 percent. In the other manufacturing industries, the labor-cost ratios range from 8.2 percent for products of petroleum and coal, to 26.4 percent in the rubber products industries. On the same basis, using the *Census of Construction*, the labor-cost ratio for the construction industry as a whole was 41.7 percent in 1929.[6]

It may be stated that, as a general rule, industries with high labor-cost ratios are those which are not well adapted to standardized quantity production on a machine basis. They are industries which depend to a great extent on the skill of the worker, that is, industries where a large percentage of operations in the productive process depend upon handicraft skills, or where the mechanical processes must be guided by highly skilled men; or industries where the inroad of machine technology has not been important and where operations require a large expenditure of unskilled labor.

One noticeable trend of modern technology has been and is in the direction of the displacement of skilled and unskilled labor by the semi-skilled type of labor. This has been particularly true of those industries where the productive processes have been shifted more and more to automatic or semi-automatic machines operated by workers having only limited training, as in the automobile, shoe, chemical, food, and textile industries. The successful adoption of the machine method of production is conditioned, however, upon several factors. The productive process must be

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[6] The figures used in this paragraph and in table V are admittedly defective; they represent, however, the only generalized statistical measures available for this type of analysis. The figures on labor-cost ratios are defective because of the varying amounts of work performed on materials before delivery to firms in the several census classifications and because of the quantities of work contracted out, in some industries, to firms in other census classifications. The figures on skilled labor, in table V, are defective because of migrations of workers from one industry to another, resulting in heavier weightings of industries at seasonal peaks on the census-taking date. The high percentage of skilled workers reported for the construction industry, also, is due at least in part to the intermittency of employment available to building trades workers. Other evidence indicates that less than three-fourths of the man-hours of labor employed by the construction industry is performed by skilled workers.

TABLE IV.—*Labor-cost ratios and hourly wage payments, education buildings erected with NIRA funds, 1933–36* [1]

State	Number of buildings	Average hourly earnings	Labor-cost ratio [2]
SOUTHERN STATES			
North Carolina	25	$0.799	35.5
Kentucky	6	.770	33.8
Florida	1	.758	38.6
Tennessee	5	.739	35.4
Virginia	37	.737	35.3
Alabama	10	.712	37.7
Oklahoma	30	.708	30.6
Georgia	11	.698	37.6
South Carolina	8	.696	36.7
Arkansas	10	.694	28.8
Mississippi	11	.648	34.4
INDUSTRIAL STATES			
Illinois	24	1.014	34.8
New Jersey	11	1.013	37.8
Connecticut	6	.977	37.5
Indiana	5	.933	38.7
New Hampshire	4	.933	36.6
Wisconsin	12	.932	31.6
Missouri	26	.910	37.4
Minnesota	14	.895	31.8
Iowa	19	.892	34.9
Rhode Island	5	.887	34.0
Maine	2	.874	37.5
Pennsylvania	13	.843	34.6
West Virginia	2	.792	37.6
Delaware	3	.758	36.9
GREAT PLAINS STATES			
North Dakota	10	.845	31.8
South Dakota	8	.808	30.2
New Mexico	4	.788	33.9
Kansas	18	.781	33.1
Nebraska	11	.769	32.0
Arizona	6	.694	28.8
FAR WESTERN STATES			
Nevada	3	1.085	30.6
Montana	17	1.035	33.2
Washington	20	.961	33.7
Idaho	4	.925	28.6
Wyoming	2	.919	37.8
Oregon	16	.918	35.7
Colorado	3	.901	28.1
Utah	6	.847	26.7

[1] Information supplied by the Bureau of Labor Statistics.
[2] Stated in percentages of total construction costs chargeable to labor at the site.

TABLE V.—*Ratio of labor cost and percentage skilled wage earners, by industrial groups, 1929*

Industry	Labor cost ratio [1]	Percent skilled workers [2]
Railroad repair shops	53.7	45.1
Printing, publishing, and allied industries	45.4	69.2
Stone, clay, and glass products	45.2	15.2
Construction	[3] 41.7	78.6
Forest products	38.2	23.8
Machinery, not including transportation equipment	37.7	47.6
Rubber products	26.4	8.9
Iron and steel and their products, not including machinery	26.3	25.8
Textiles and their products	25.4	13.3
Leather and its manufactures	24.1	2.4
Paper and allied products	20.8	13.4
Transportation equipment	20.4	37.7
Nonferrous metals and their products	15.2	29.5
Chemical and allied products	15.2	13.5
Food and kindred products	9.5	7.5
Products of petroleum and coal	8.2	27.2

[1] *Biennial Census of Manufactures*, 1931, pp. 37–38, except for construction.
[2] Computed from *Census of Population*, vol. V, General Report on Occupations, ch. 7, 1930.
[3] *Construction Industry Census*, 1930, p. 23.

capable of being organized as a continuous flow; it must be possible to break the operations to be performed into simple parts so that they may be turned over to specialized machines; and, finally, the material used and the end product must be relatively standardized, uniform and constant in size and shape.

It is, of course, patent that, at the present time, none of these conditions exist in the residential construction industry, and that by its very nature the industry will find it difficult to meet the requirements of modern technology. It does not follow that the construction industry is entirely closed to the introduction of mechancial appliances, for, as a matter of fact, certain operations formerly performed by human labor have already been mechanized. The trenching machine, the excavator, the crane, the bucket conveyor, the plaster and cement mixer, have already mechanized many operations and have displaced numerous workers. The mechanization of certain simple operations, however, is not the same thing as the introduction of machine technology in the productive process as a whole; for the latter presupposes a development of a system of machines which makes possible not only a considerable displacement of labor in general, but also the replacement of highly skilled by semiskilled labor.

Despite a certain degree of mechanization already obtained, the construction industry in general, and residential construction in particular, remains essentially a handicraft industry where building operations depend largely on highly skilled labor. In this respect, as shown in table V, the construction industry indeed stands out in marked contrast to all other major industries.

According to the 1930 *Census of Occupations*, 78.6 percent of all labor in the construction industry was listed as skilled labor.[7] The nearest approach to this percentage of skilled labor to the total is found in the printing, publishing and allied industries where it was 69.2 percent; followed by machinery, not including transportation equipment, with 47.6 percent; and railroad repair shops with 45.1 percent. If we compare column 2, percentages of skilled workers, with column 1, labor cost ratios, in table V, we note that, in most

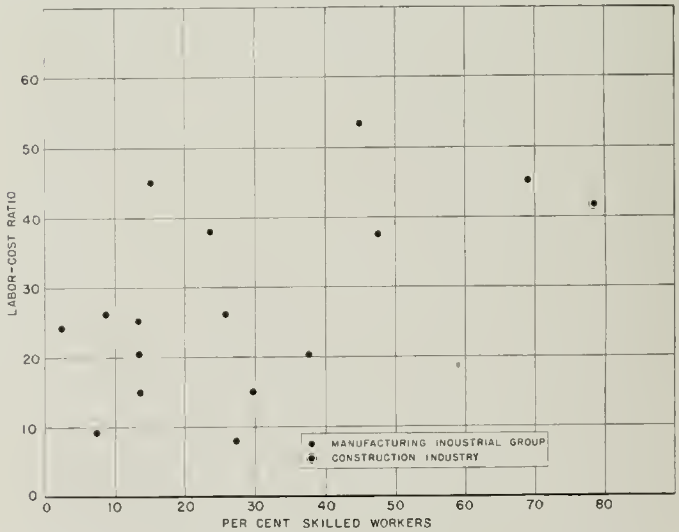

FIGURE 36.—Correlation of labor cost ratios and percentage skilled workers to all wage earners, 15 manufacturing industrial groups, and the construction industry.

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[7] See footnote 8, p. 81.

cases, the industries with high labor-cost ratios are also the industries with relatively high proportions of skilled workers.[8]

Rates of Pay and Annual Earnings

The hourly rates of pay for skilled workers in the construction industry are admittedly high when contrasted with the hourly rates of pay for semi-skilled and unskilled labor in the manufacturing industries. They do not seem to be out of line, however, with the hourly rates paid to highly skilled workers in the manufacturing industries, and the average actual annual earnings of skilled construction workers are in reality lower than the annual earnings of similarly qualified workers engaged in the manufacturing industries.

A comparison of the rates of pay in the construction industry with the rates of pay in other industries based on averaging the hourly rates of pay for all groups of workers, skilled, semiskilled, and unskilled, and including, in many cases, large numbers of women and young people, is obviously inadequate and misleading because of the disproportionately high ratio of skilled workers in the construction industry as compared to other industries. The only significant method of comparison is to contrast the rates of pay for skilled workers in the construction industry with the rates of pay of skilled workers in other industries. Table VI presents data for 1929 on the average hourly rates of pay for selected groups of skilled workers in the construction industry, printing and publishing, metal trades, and iron and steel industry.

TABLE VI.—*Average wage rate per hour of selected groups of workers in building trades, metal trades, printing and publishing, and iron and steel industry, 1929* [1]

	Hourly rate		Hourly rate
Building Trades: [2]		Metal trades—Continued:	
Bricklayers	$1.48	Pattern makers	$1.21
Carpenters	1.16	Molders	1.15
Painters	1.22	Iron and steel industry:	
Plumbers	1.39	Heaters (average for puddling mills, blooming mills, and plate mills)	1.31
Plasterers	1.45	Rollers (average for puddling, blooming, plate, standard rail, bar, sheet and tin plate mills)	1.64
Sheet metal workers	1.20	Blowers (Bessemer converters)	1.30
Printing and publishing (book and job): [2]		Vesselmen (Bessemer converters)	1.21
Hand compositors	1.05		
Electrotypers	1.13		
Machine operators	1.10		
Photo engravers	1.26		
Metal trades: [3]			
Blacksmiths	1.27		
Boilermakers (outside)	1.35		
Machinists, erection, press repair and maintenance	1.29		

[1] Source: Data for building trades, printing and publishing, and metal trades compiled from *Union Scale of Wages and Hours of Labor*, May 15, 1930. U. S. Department of Labor, Washington, 1931. Data for iron and steel industry compiled from *Wages and Hours of Labor in the Iron and Steel Industry*, 1931. U. S. Department of Labor, Washington, 1932.

[2] The rate of pay is an average of union rates in seven selected cities: Atlanta, Ga.; Birmingham, Ala.; Cincinnati, Ohio; Chicago, Ill.; Milwaukee, Wis.; San Francisco, Calif.; and Washington, D. C.

[3] For each craft, the rato of pay is an average of the union rate for several cities, varying from three cities for machinists to eleven cities for pattern makers.

From the standpoint of standards of living, comparison of hourly rates are not as significant as comparison of annual earnings. Analysis of total wage payments, in terms of the average number of workers employed throughout the year, as reported in the 1930 *Census of Construction*, indicates that the average earnings of such workers was $1,770. On the basis of similar analyses, with the exception of the printing, publishing, and allied industries, where the average annual earnings were $1,775 for the year, the average annual earnings were higher in the construction industry than in any others. The range for other industries was from $1,015 for textiles and their products, to $1,617 for the transportation equipment industry.[9] These averages are for all classes of workers, skilled, semiskilled, and unskilled, actually employed during the year. If the annual wage payments of the manufacturing industries are compared with the percentages that the skilled workers are of the total wage-earners employed, by industrial groups, a striking correlation is found to exist. These figures are presented in table VII, and their relationship is graphically revealed in the accompanying chart, figure 37.

These figures become relevant, however, only when considered in terms of the total numbers of workers available for employment in the various industries, as compared to the average numbers employed through the year. There are no definite figures to permit accurate determination of these relationships. Several estimates, however, lead to the conclusion that there were from 1.5 to 3 building trades workers available for every full man-year's employment in 1929, and only from 1 to 1.5 workers available for each full man-year's employment in the manufacturing industry. Such a high ratio is apparently required by an industry which concentrates its employment in particular seasons and in which a high degree of correlation between job specialization and labor skills is established.

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[8] It should be observed that the column "percentages of skilled workers," is based on the *Census of Occupations* and refers only to those claiming a given skill in a given industry; it does not represent the actual relationship of those actively employed in industry. Comparison of the numbers of workers by industries, as given in the 1930 *Census of Occupations*, with the figures given in the *Census of Manufactures* tends to confirm the belief, although minor discrepancies are present, that the distribution of workers by occupational classification in the *Census of Occupations* is essentially similar to that given in the *Census of Manufactures*.

[9] On the same basis, average annual wage payments to certain classes of skilled workers have been obtained with regard to employment on railroads in 1930. Skilled maintenance of way and maintenance of equipment workers, on this basis, received from $1,453, in the case of bridge and building painters, to $2,033 in the case of class A electrical workers. The figures, by groups of workers, were as follows:

Electrical workers, class A	$2,033
Electrical workers, class C	1,940
Portable steam equipment operators	1,919
Sheet metal workers	1,876
Bridge and building iron workers	1,852
Masons, bricklayers, plasterers, and plumbers	1,844
Electrical workers, class B	1,838
Blacksmiths	1,770
Bridge and building carpenters	1,486
Bridge and building painters	1,453
Skilled trade helpers	1,179

Data from monthly *Wage Statistics, Class I Steam Railways in the United States*, for the 12 months ending December 1930. Interstate Commerce Commission, Bureau of Statistics.

TABLE VII.—*Average annual wage payments and percentage skilled workers of all wage-earners, by manufacturing industries and the construction industry, 1929*

Industrial group	Average annual wage payments [1]	Percent skilled workers of all wage-earners [2]
Printing, publishing, and allied products	$1, 775	69. 2
Construction	1, 770	78. 6
Transportation equipment	1, 617	37. 7
Railroad repair shops	1, 600	45. 1
Iron and steel and their products, not including machinery	1, 568	25. 8
Products of petroleum and coal	1, 556	27. 2
Machinery, not including transportation equipment	1, 497	47. 6
Nonferrous metals and their products	1, 409	29. 5
Rubber products	1, 389	8. 9
Stone, clay and glass products	1, 317	15. 2
Chemicals and allied products	1, 261	20. 2
Paper and allied products	1, 231	13. 4
Food and kindred products	1, 198	7. 5
Leather and its manufacture	1, 129	2. 4
Forest products	1, 072	23. 8
Textiles and their products	1, 015	13. 3

[1] Based on *Census of Manufactures.*
[2] Based on *Industrial Census of Occupations*, 1930.

The American Federation of Labor, reporting unemployment among union members that year, estimated unemployment among union building trades workers at 25 percent; the corresponding figure for metal trades workers was only 7 percent, and for typographical workers only 4 percent. Paul H. Douglas, surveying the experience of the first quarter of this century, estimated that unemployment among building trades workers, on the average, amounted to 22 percent, as compared to 7 percent for workers in the manufacturing and transportation industries. Reducing the annual earnings figures given above, by Douglas' percentages, as a matter of rough illustration, the average annual earnings for all building trades workers becomes $1,381, and for all workers, including women and young persons, in the manufacturing industries, $1,223. When it is recalled that 78.6 percent of the building trades workers, as reported in the industrial breakdown of the Census of Occupations, were skilled mechanics, as against 27.5 percent of the workers in the manufacturing industries, it is apparent that the assumption that building trades workers are grossly overpaid is at least an exaggeration,

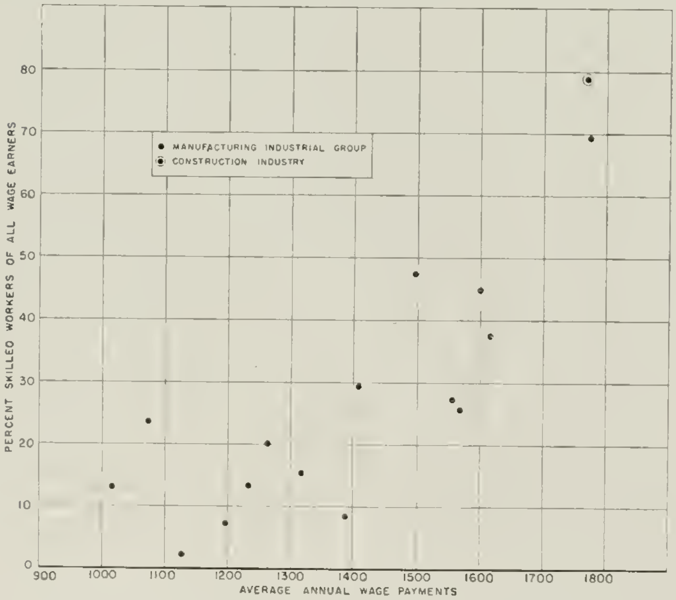

FIGURE 37.—Correlation of average annual wage payments to wage earners and percentage skilled workers of all wage earners, 15 manufacturing industrial groups, and the construction industry.

A similar comparison of average annual wage payments, with a clearer definition of the manufacturing industries, is available from figures collected by the Ohio Division of Labor Statistics.[10] During the 6-year period, 1924 to 1929, the average annual wage payments to wage earners in the construction industry was $1,635, and to wage earners in all manufacturing industries, $1,467. In order to make comparison more realistic, however, the construction industry should be contrasted with industries not employing women and young people and which are dependent to a considerable degree on skilled workers. The $1,635 average annual wage payments of the construction industry should be compared, therefore, with the figures of $1,873 for the blast furnace products industry and of $1,877 for steel works and rolling mills. The rubber products industry, important to Ohio, but employing a considerable number of women and a relatively small number of skilled workers, made average annual wage payments of $1,568.

If the total annual wage payments, however, had been distributed among the average maximum numbers of workers in the construction industry and in the steel works and rolling mills, the average annual earnings of the construction workers would have been $1,317, and of the steel works and rolling mills workers $1,742. Since the average maximum numbers of workers tend to approximate, in times of normal employment, the working forces available for employment in the several industries, these figures are more representative of probable average annual earnings than are the figures given in the preceding paragraph. It is likely, however, that the average maximum numbers of workers underestimate the total available labor forces more in the case of the construction industry than in the case of the steel works and rolling mills, or of any of the manufacturing industries. Exactly similar comparisons cannot be made for the other manufacturing industries, or for all manufacturing industries, because corresponding figures are not available. Such figures as are available, however, indicate that such adjustments would probably result in average annual payments to the average maximum numbers of workers in excess of those made to construction workers, even in the case of all manufacturing industries.

The possibilities of underemployment in the building trades are greater than in the manufacturing industries.

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[10] Presented in Bulletin 613, *Average Annual Wage and Salary Payments in Ohio, 1916 to 1932*, Bureau of Labor Statistics, U. S. Department of Labor.

Both types of employment are subject to short-time interruptions because of delays in the delivery of material, because of irregularities in the completion of steps in the processes of production,[11] because of irregularities in the receipt of orders, and because of seasonal variations in demand for their products. The construction industry, however, involving extensive out-door operations dependent on weather conditions, subject to wide seasonal variations in employment, amounting, in 1929, to a difference of 76 percent between the minimum and the maximum employment conditions, and to recurrent daily interruptions, is probably less able to provide full-time weekly employment than the indoor manufacturing industries. The only available figures concerning underemployment are based on the experience of union members. Figures compiled by the American Federation of Labor indicate that in 1936 (the series was begun in 1930), in addition to the 25 percent of the union building trades workers unemployed, 29 percent were employed on a part-time basis only. Underemployment of metal trades workers amounted to 13 percent; of printing trades workers, 27 percent; of other trades, 18 percent; and the average of all trades was 20 percent.

According to these reports, in 1936, an average of only 46 percent of the workers in the building trades were fully employed, as against 79 percent for the metal trades, 63 percent for the printing trades, and 72 percent for all other trades; the average for all trades was 68 percent. No figures are available concerning the percentage of time lost by workers employed on a part-time basis.

TABLE VIII.—*Unemployment, underemployment, and full-time employment, A. F. of L. union members, 1931–37* [1]

	All trades		Building trades		Metal trades		Printing trades		Other trades		Fully employed				
	Unemployment	Part-time employment	Unemployment	Part-time employment	Unemployment	Part-time employment	Unemployment	Part-time employment	Unemployment	Part-time employment	All trades	Building trades	Metal trades	Printing trades	Other trades
1931	26	19	52	17	30	25	13	24	17	18	55	31	45	63	65
1932	32	21	64	15	42	26	19	38	20	20	47	21	32	43	60
1933	31	21	67	16	43	24	22	38	20	20	48	17	33	40	60
1934	26	24	57	22	27	18	18	37	18	22	50	21	55	45	60
1935	23	23	52	25	22	27	15	34	17	20	54	23	51	51	63
1936	17	21	33	29	13	20	12	31	14	18	62	38	67	57	68
1937 [2]	12	20	25	29	8	13	10	27	10	68	68	46	79	63	72

[1] Average of monthly percentages of union members reported unemployed, part-time employed, or fully employed.

[2] First 9 months only.

Compiled from monthly *Trade Union Unemployment Report*, American Federation of Labor.

Aside from seasonal interruptions in the construction industry, and other irregularities due to weather conditions, the continuity of employment with any given contractor is always of short duration. In 1920, for example, an investigator was able to secure a record of employment of a Philadelphia bricklayer over a period of several years. His record indicated that in 1913 he was hired 12 times by 9 different contractors over a period of 9 months; in 1917 he was hired 14 times by 11 different contractors. He was hired 28 times by 18 different contractors in 1915, and 22 times by 19 contractors in 1916.[12]

That the percentages of unemployment among skilled building trades workers are not exaggerated is confirmed by a number of studies of time lost by various crafts in the building industry. An examination of a number of individual workers' time books in Philadelphia in 1920 indicated that, out of an average of 275 possible effective working days in that year, an average of only 189 days' employment was available to these workers, a loss of 31 percent of their potential working time.[13]

Another study in the same city in 1922 indicated that the skilled workers involved in the study received actual earnings equal to only 70 percent of what they might have earned if they had been able to secure employment on all of the effective working days of that year. The average actual earnings of these skilled workers amounted to only $1,540.95; if they had been able to work full time on the effective working days of the year they would have earned an average of $2,194.36. Plasterers were unemployed an average of 84 working days, or 33 percent of the possible working time; carpenters, 80 days, or 29 percent; bricklayers, 93 days, or 34 percent, etc.[14]

Records kept by a small number of Philadelphia bricklayers during the period 1909 to 1920 indicated that the number of days work per year varied from a minimum of 138 to a maximum of 231, and annual earnings varied from $789.29 in one of the earlier years to $2,403.52 in 1920.[15] In Rochester, N. Y., in 1920, the actual annual earnings of 519 skilled workers amounted to only $1,381.58.[16]

Tentative figures collected under the auspices of the National Recovery Administration, representing average annual earnings of organized building trades workers in varying numbers of cities, indicated that, in 1929, painters in 9 cities received average incomes of less than $1,000; in 14 cities, from $1,000 to $1,199; in 8 other cities, from $1,200 to $1,499; in the one remaining city reported, the average was $2,200. Electricians in one city received annual earnings of less than $1,200; in two cities, from $1,500 to $1,799; and in two other cities,

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[11] On this point, see "Employment in the Construction of an Apartment House," *Monthly Labor Review*, October 1932, p. 782.

[12] Haber, W. T., *Industrial Relations in the Building Industry*, pp. 100–101, quoted from *Waste in Industry*, p. 65.

[13] Haber, *op. cit.*, p. 98; quoted from *Waste in Industry*, p. 64; also in *Monthly Labor Review*, May 1921.

[14] Haber, *op. cit.*, p. 99; quoted from *Waste in Industry*, p. 63; taken from *Engineering News Record*, January 11, 1923.

[15] Haber, *op. cit.*, p. 100; taken from *Engineering News Record*, January 11, 1923.

[16] Haber, *op. cit.*, p. 105.

Detroit and Pittsburgh, more than $1,800. Plumbers in two cities received from $1,200 to $1,499; in one city, over $1,500. Brick masons in one city received less than $1,500 on the average, and in two others, New York and St. Louis, from $1,800 to $2,000. Tile setters received an average, in the two cities reported, of a little more than $2,000 per year. Plasterers in California received an average of $1,265 and lathers received $937. While these reports did not include figures for some of the highest paid crafts, and in some cases did not include the highest wage rate areas, on the other hand, the cities covered were fairly representative, and none of the crafts covered are of the lower paid groups. Furthermore, the reports were for the year 1929, which was a year of fairly normal activity and employment. Hourly wage rates were as high as they had ever been. The annual earnings reported, however, are distinctly not high, when compared to the earnings of skilled workers in other branches of employment in that year.[17]

The Farm Security (Resettlement) Administration collected information on the earnings of workers on seven of its projects which had been under construction for 12 months or longer. The records were secured only for workers who had been continuously on assignment for 12-month periods at the peaks of employment. Hours of work were limited to 140 monthly, but every effort was made to provide continuous employment, including winter operations throughout the year. Even under these circumstances, however, interruptions due to delayed arrival of materials, delays in receipt of plans, or impossible weather conditions, reduced the workers' earnings to only 86.3 percent of the possible maximum allowed by the 140-hour month. Furthermore, of a maximum of 5,957 skilled workers employed on these projects during the peak months, only 1,002, or 16.8 percent of them, were able to maintain a full year's employment relationship with the projects.[18]

The average annual earnings of these full-time skilled workers exceeded $2,000 only on the Greenbelt project near Washington, D. C. Here, the average earnings amounted to $2,010. On four other projects, the averages lay between $1,500 and $2,000. These figures were as follows: At Cincinnati, $1,970 (the lower-paid skills averaged $1,203); at Milwaukee, $1,897; near Trenton, N. J., $1,634; and near Birmingham, Ala., $1,656. The average earnings at Duluth, Minn., amounted to $1,370, and at Newport News, Va., $1,007.

On several other projects, initiated too recently to permit gathering information on the basis of a full year's experience, data were collected for six, eight, and ten months' periods, and adjusted to an annual basis. The results of these surveys indicated average annual earnings of full-time skilled workers as follows: At Ironwood, Mich., $1,110; near Wilmington, N. C., $1,018; near Pine Bluff, Ark., $1,161; and at Wichita Falls, Tex., $1,555.[19]

TABLE IX.—*Number of skilled workers on continuous assignment for twelve-month period, 7 Resettlement Administration projects; maximum number skilled workers employed in any pay roll period (15 days), minimum number, and average number, 1936–1937* [1]

Project	Number continuously employed	Maximum employment	Minimum employment	Average employment
Newport News	54	409	112	200
Cahaba	14	350	62	270
Duluth Homesteads	12	250	24	101
Jersey Homesteads	45	423	86	263
Greendale	217	1,382	516	791
Greenhills	453	1,337	810	1,090
Greenbelt	207	1,806	651	1,302
Total	1,002	5,957	2,261	4,017

[1] Compiled by the Labor Relations Division, Farm Security Administration.

The economic position of construction workers as a whole was more drastically undermined in the period of 1929 to 1936 than that of any other wage-earning group. Not only was the decline in employment in construction greater than in other industries, but since the recovery following 1933, it has shown far less improvement, as is indicated by table XI. The construction industry was one of the first to be hit by the last depression, and its decline was more pronounced than that of the manufacturing industries. On the other hand, the process of recovery started later in the construction industry than in the manufacturing industry, and it continues to lag badly.

Within the construction industry itself, residential building tends to lag in comparison with the other branches of construction. The ratio of residential construction to total construction during the period 1928 to 1936 declined from 42.1 percent in 1928 to 16.1 percent in 1934, rising to 26 percent in 1935, and to 30 percent in 1936.

Explanations of these lags have not been clearly established. It has been argued that high costs of labor in the construction industry have much to do with the inability of the industry as a whole to expand and that they prevent private industry or government from operating on a scale adequate to meet the needs of low-income groups. Many of these arguments have been directed at reputed high wage scales of the building trade unions and at alleged costly employment regulations imposed by unions upon contractors. It must not be overlooked with regard to these arguments, that little detached residential construction in this country has been performed by union labor, and that union labor has been employed on large-scale, privately erected,

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[17] From an unpublished report of the National Recovery Administration, *Characteristics of Area Agreements Approved by the President, and Characteristics of Divisions and Areas Covered by Them.*

[18] See table IX.

[19] See table X.

TABLE X.—*Average hourly and annual earnings of skilled workers on continuous assignment to Resettlement Administration housing projects* [1]

	Carpenters		Painters		Plumbers		Bricklayers		Electricians		Cement finishers		Sheet metal workers	
	Hourly rate	Annual earnings	Hourly rate	Annual earnings	Hourly rate	Annual earnings	Hourly rate	Annual earnings	Hourly rate	Annual earnings	Hourly rate	Annual earnings	Hourly rate	Annual earnings
Greenbelt	$1.40	$2,006.40	$1.409	$2,087.18	$1.502	$2,255.18	$1.558	$1,942.08	$1.66	$2,449.08	$1.376	$2,107.05	$1.504	$2,087.70
Greenhills	1.35	1,937.55	1.246	1,720.50	1.314	2,037.87	1.466	2,008.59	1.304	2,037.35	1.264	1,892.52	1.228	1,748.53
Greendale	1.144	1,718.61	1.04	1,549.50	1.254	1,992.89	1.296	1,862.54	1.27	1,990.33	1.23	1,867.97	1.084	1,733.85
Jersey Homesteads	1.10	1,601.47	1.02	1,504.21	1.264	1,985.75	1.25	1,567.79	1.65	1,592.66	1.25	1,608.12	.942	1,415.50
Ironwood [2]	.83	1,126.95			.979	1,212.14			.838	1,113.98	.506	634.20		
Duluth	.987	1,345.36	1.024	1,527.67	1.1315	1,456.25								
Cahaba	1.00	1,583.00	1.012	1,501.20	1.28	2,096.55	1.30	1,942.79	1.24	1,868.45			1.015	1,628.16
Penderlea [3]	.733	1,067.54					.941	1,131.60			.60	788.40		
Wrights Plant [4]	.85	1,181.56	.826	1,121.10	.85	1,203.00	1.00	1,122.00	.85	1,218.90				
Shenandoah Parks [3]	.57	927.46												
Newport News	.6718	1,001.93	.6295	857.93	1.037	1,567.56								
Wichita Valley [4]	1.026	1,618.23	.82	1,235.32			1.25	1,513.09						
Western Slope [3]	1.10	1,793.58					1.25	900.00						
Arizona [3]	1.00	1,544.86							1.00	1,278.00				

	Composition roofer		Reinforcing rodman		Glazier		Steamfitter		Structural iron worker		Plasterers		Shovel operators	
	Hourly rate	Annual earnings	Hourly rate	Annual earnings	Hourly rate	Annual earnings	Hourly rate	Annual earnings	Hourly rate	Annual earnings	Hourly rate	Annual earnings	Hourly rate	Annual earnings
Greenbelt			$1.378	$1,835.77	$1.293	$1,855.45	$1.495	$2,227.24			$1.587	$2,197.87	$1,842	$2,522.98
Greenhills	$1.10	$1,342.33					1.352	2,063.11	$1.372	$1,885.25	1.354	2,008.25		
Greendale									1.293	1,930.12				
Jersey Homesteads	1.225	1,678.14												
Cahaba													1.255	1,967.11
Arizona [3]											1.00	1,228.00		

[1] Figures on projects so indicated based on employment for less than a year's time, adjusted.
[2] 10 months only.
[3] 6 months only.
[4] 8 months only.

multiple-unit dwellings in only a relatively small number of cities. In view of these circumstances, and of the inactivity pervading the unorganized field as well as the organized field of construction work, it appears that the search for obstacles in the way of extensive housing for low-income groups must be pursued in other directions.

Efficient Utilization of Labor

Analysis of labor costs in residential construction indicates that the most important factors are: concrete work (in large-scale buildings only), carpentry work (the most important item in detached houses, but relatively unimportant in large-scale buildings), brickwork (except in frame houses), plumbing and heating, lathing and plastering, and painting. Most of the efforts to discover savings with regard to these items have revolved around a search for substitute materials, or around the simplification of designs and installations in the case of plumbing and heating. Little has been discovered so far, however, in the way of satisfactory substitutes which will result in economies in the use of labor without increasing the costs of materials.

The major economies in labor costs appear to lie in the simplification and standardization of designs, materials, and processes. This does not mean that it is necessary to use a monotonous factory design of houses, but it does mean that the designs of the details should be standardized. Practicing journeymen have been unanimous in their statements that, with a simplified and standardized design, it would be possible for crews of workmen to familiarize themselves with the work to

TABLE XI.—*Percent decrease of employment indices in construction and other industrial groups, 1929–33 and 1929–36* [1]

Index	Percent decrease	
	1929–33	1929–36
Employment in construction industry [2]	52.1	33.0
Employment in manufacturing	35.5	17.1
Employment in mining	41.2	21.0
Employment in transportation	34.9	27.0
Employment in public utilities	26.5	24.4
Employment of casual workers	14.6	4.0

[1] Based on data of the U. S. Bureau of Labor Statistics.
[2] Construction includes all contract construction, as well as force account construction by public authorities, including the Public Works Administration. No Federal projects are included except those supervised by the Public Works Administration and the Bureau of Public Roads.

TABLE XII.—*Percentage distribution of labor costs in residential construction* [1]

	Detached [2] residence	Large-scale [3] apartments	Expensive [4] residence
Excavation and grading	4.4	4.9	3.8
Brickwork	7.8	25.8	19.6
Carpenter work	42.9	6.6	33.1
Tile work	1.8	2.2	2.8
Concrete and cement work	4.3	15.0	5.4
Electric wiring and fixtures	2.0	5.1	1.4
Heating	8.4	4.6	5.5
Plumbing	8.5	9.8	4.9
Plastering and lathing	4.8	12.9	8.8
Painting	7.9	4.6	5.4
Papering	3.0		1.0
Roofing	4.1	.7	6.3
Miscellaneous	.1	7.8	2.0

[1] Data supplied by Bureau of Labor Statistics.
[2] Washington, D. C., 1936–37, frame buildings, $4,000–$5,999.
[3] Knickerbocker Village, New York City, in *Monthly Labor Review*, September 1935.
[4] Washington, D. C., 1936–37, brick buildings, $10,000–$11,999.

be done on the first units of a housing project, and to apply that familiarity on the succeeding units with resulting efficiency and economy. Standardized materials, also, permit the workers to become acquainted with the production processes so that they, in later units, increase the efficiency with which they work. The experience of contractors and of government agencies indicates that the economies resulting from such increased efficiency would probably exceed any economies that could, within the limits of possible realization, be secured from wage rate reductions.

Simplification and standardization of designs, materials, and processes also offer the possibilities of new techniques and developments which may result in worth-while labor economies. Simplified and standardized designs and materials make it possible to set up on-site "factories" for precutting or prefabrication of certain units used in the building process. This is particularly true with regard to precut plants for lumber and for the prefabrication of a number of minor items. The principles of the factory assembly line may be adopted on large-scale developments, through organization of crews in such a way that they can begin work at one point of the development, and repeat the operations throughout the job. This results in the development of a group of men accustomed to working with each other and quickly familiarized with all the processes in which they are involved. A considerable increase in the efficiency of the whole working force is thereby secured. Economies from either of these possibilities, it is reiterated, are dependent upon the development of simplified and standardized designs, materials, and processes and upon large scale operations.

More important labor economies may be found, in the case of large-scale residential developments, in careful organization and management of the labor force. To secure the most efficient results from the labor force, more careful planning of construction operations will be necessary. No efficient manufacturer would begin operations on a large scale until he possessed the detailed plans for his work and until he had most carefully considered the relationship of every worker to be employed to every other worker, and to the flow of materials through the factory from one process to another, and until he was relatively well assured concerning the flow of raw materials to his plant. Similarly, if the greatest economy in the employment of labor is to be secured, the builder, before beginning his first operations, must have carefully laid out the types and sizes of labor crews which he expects to employ, the beginning dates of their employment, the relationship of the employment of each crew to every other crew; and he must have timed the delivery of his materials to fit into the schedule of developments in such a way that lost motion, recurrent unemployment of crews or of individuals, has been eliminated except for those eventualities over which no builder can exercise control.

If efficient results are to be achieved in building activities, the development of a fully rounded force for operations must not be sacrificed for speed in getting projects initiated. Agencies must not be rushed into building operations before they have had time to complete the details of their development, and contracts must make allowances with regard to elapsed time before beginning work in order to permit the builders to develop efficient working programs. Parties responsible for the project must give consideration, also, to local labor situations and to other building developments that may be undertaken, and consultation must be had and arrangements made with the local representatives responsible for the control of the labor supply to assure effective compliance with the working program that is developed.

Many students of housing have advocated making the labor economies outlined above even more effective through the transfer of many of the jobs performed on the production site to the factory. Such an achievement, it was felt, would make possible the use of more power, would make possible greater specialization of labor, which might result in lower hourly wage payments (perhaps accompanied by greater continuity of employment), and would reduce the tasks to be performed on the erection site to a relatively small number of considerably simplified operations. Some of the explorers of such possibilities have apparently felt that they might result in the elimination of a need for highly skilled labor and make possible the employment of specially trained semiskilled workers at hourly rates of pay proportionate to those received by the semiskilled workers employed as factory operatives.

An investigation of one enterprise engaged in prefabrication of housing revealed that, according to tentative estimates, the labor-cost ratio on a $3,500 house (building construction cost only) amounted to approximately 34 percent; 28 percent of the cost was for on-site labor, and 6 percent was in the factory. In this case, all plumbing, heating, and electrical installations were of the orthodox type, with minor qualifications, and were performed in the usual methods. It was not clear, however, that the cost of the substitute materials used in this house was not higher than in similar houses of orthodox construction, or that the actual expenditures for labor were not as large as they would have been in erecting equivalent houses of orthodox materials.

Organized Labor and Building Labor Costs

Organized building trades unions are the objects of extensive criticism in almost every discussion of the problem of providing adequate housing for low-income groups. First, it is charged that their hourly wage rates are abnormally high and that they undertake to secure unduly large earnings for themselves at the expense of low-income families seeking decent living quarters. Second, they are charged with restricting the labor supply through unnecessary restrictions on apprenticeship and through closed shop requirements and closed union memberships, by means of which they obtain monopolistic privileges. Third, it is claimed that, through the imposition of restrictions on output they interfere with the efficient performance of labor and with efficient operations.

High Wage Rate

The evidence presented in the first section of this report makes it clear that the wage rates of building trades workers, when compared to similarly qualified workers in other industries, are not unduly high. The annual earnings of skilled building trades workers, especially those in unions, are, of course, higher than those of the lowest income groups it is desired to house; but the same is true of the professional, technical, and clerical workers employed in the building industry.

Under these circumstances, it cannot be maintained that the unions are in any improper way responsible for unduly high wage costs, unless it can be shown that they have created artificial market conditions. Such conditions could be created through limitation of the supply of labor, or, at least, the flow of that supply to the market, or through manipulation of the effectiveness of the supply after it reaches the market.

Restricted Labor Supply

Union rules usually require from 2 to 4 years apprenticeship, usually limit the number of apprentices who can be employed in terms of ratios to journeyman craftsmen, usually provide minimum or maximum age limits, or in some cases, both, and usually provide relatively low wage rates and limited hours of work for the period of apprenticement. These rules were developed primarily for the purposes of insuring adequate training, avoiding child labor, prohibiting the employer from substituting low-wage apprentice labor for higher-wage journeyman labor, and insuring the apprentice opportunities for employment which would not result in displacement of already qualified craftsmen. On the other hand, a requirement that the apprentices shall be indentured for the entire training period to one given employer, who, in turn, is required to give him sufficient employment and experience for the purpose of his training, has caused employers to object to participation in the program. As a result, these rules have had the effect of discouraging young persons from entering the trades, and of practically prohibiting adult workers, transferring from other trades, from hiring out as apprentices. Workers transferring from other trades, therefore, usually enter the building trades with little experience or training, and because of their incompetency, they are willing to accept wage rates definitely below the scales established by union workers. In view of these circumstances and of the abundant supply of persons offering themselves for employment as skilled construction workers, it is not surprising that the unions should undertake to limit membership in their organizations.

Unions limit membership, especially in well-organized communities, by means of high initiation fees and trade examinations. Local unions sometimes "close their books" and refuse to accept new members under any circumstances. By a system of permit cards, they sometimes shut out of local employment union workers from other cities who have found it desirable to seek work away from home.* On the other hand, in boom periods, when the unions are obligated by their contracts to secure more workers than their memberships will provide, they sometimes arrange for the importation of union members from elsewhere rather than permit employment of local nonunionists. At other times, they will permit the employment of local nonunionists under a permit system, involving the payment of weekly fees by persons whom they will not allow to affiliate with their organizations. Such arrangements meet the local demand for labor without permitting a permanent increase in the local supply of union craftsmen. Some unions, also, have adopted racial criteria as a means of restricting the supply of local union craftsmen, and as a result, they tend to shut out of the building trades members of the races against whom prejudice exists.

These restrictions sometimes give the impression that the local unionists are attempting to maintain a monopoly on employment for the benefit of the selected workers who are members of the unions. The public cannot reconcile these regulations with the announced objectives of the unions to organize all workers, or with their recurrent organization campaigns. The unions usually attempt to meet the public reactions to these regulations with rationalized statements concerning the asset value of membership in the organizations or the qualification standards which they have established for journeymen workers. The fundamental basis for their policies, however, lies in the fact that unions are primarily interested in an attempt to limit the supply of building trades workers to the number of jobs to which they can be assigned. Their organization drives are necessary to secure control of the desirable jobs; but once control has been secured, the primary concern of the union becomes one of insuring employment to all of its members.

Nevertheless, it must be frankly recognized that the unions, when they control entry into the building trades, at times overstep reasonable bounds. There are instances in particular localities where a limited number of craftsmen in a particular trade have interfered with the flow of work and thus unduly raised the costs of construction. When individual unions overreach themselves in this way, it is doubtful whether the interest of the labor group itself is protected, since the restrictions are likely to encourage the use of substitute materials employing different labor skills or to discourage construction.

Furthermore, in view of the limited number of workers entering the trades by the apprenticeship route[20] and of the large number of workers entering after maturity, without supervised training, the organized labor movement as well as the construction industry would probably benefit from a reconsideration of their apprenticeship program. If the training of young persons for the trades could be revitalized through modifications of the indenture provisions, and if training programs were further broadened to cover mature persons who find it necessary to adopt new trades and to give further training to skilled mechanics who need to learn new processes and new materials, the unions would probably secure a better control over an unstable market and the industry would benefit from the availability of better qualified mechanics.

Restrictions on Output

The most usual types of restrictions that have been discussed can be summarized as follows:

1. *Rules limiting output.*—A few unions specifically prescribe limitations on production. Some painters' locals have limited the width of the paint brush; some lathing locals have limited the number of laths that may be put up in a day; some local unions of bricklayers have "understandings" concerning the number of brick to be laid in a day. More generally, it is asserted that, at the union meeting, the leaders advise their members that on certain jobs they were working too fast, or criticize certain members for producing too much.

2. *Rules restricting the use of machinery or other labor saving devices.*—There are few specific cases that can be cited with regard to limitations upon the use of machinery. The painters' union again is most often cited for its opposition to the use of the spray gun. The plumbers are cited for their opposition to the performance of work in the shop, and for an outworn rule forbidding the use of a bicycle in going to and from work. The cement masons are cited for their objection, sometime in the past, to the use of the cement mixer or to the use of accelerators in concrete or of more efficient leveling devices; and so on.

3. *Specification of the number of workers to be employed.*—A few unions can be cited for rules specifying "full crews" which must be used in the construction processes. The engineers are probably most often referred to because of their rules, in some cases, requiring one man to a machine or on heavy machinery requiring an engineer and an oiler, where it is thought that the engineer alone could perform the necessary work. Reference is also made to the requirement of the steamfitters that every journeyman be accompanied by a helper or to the ironworkers who regulate the number of men in a riveting gang. Most unions also regulate the number of men who can work for a foreman or the number of men who can work without one man being employed at the higher foreman's rate. In some cases, it is required that where only one journeyman is employed, he must be paid the foreman's rate in spite of the fact that he has no supervisory functions. On the other hand, reference is made to the effect of jurisdictional claims which often result in the requirement that the contractor assign men from competing crafts to do the work that the men of one craft only should be required to do or to the fact that, as a result of jurisdictional claims, several men must be present for the performance of one relatively simple job. An example of the first case would be the necessity of employing an electrician and an engineer to operate an electric motor because of the fact that both unions claimed the jurisdiction for its own members. An example in the second case would appear in a minor renovation of a steam boiler which would require a brickmason for the removal and replacement of firebrick, an asbestos worker for the removal and replacement of asbestos, a steamfitter for the unjointing and recutting of pipes, etc.; cases have been cited where three or four men and their helpers were required to do the work that could reasonably be done by one man and a helper in a period of one or two hours.

4. *Jurisdictional disputes between skilled crafts and between skilled and unskilled workers.*—Probably the most emphasized of the restrictive provisions of labor unions have been those resulting in jurisdictional disputes. The disputes have most often occurred as a result of changes in construction materials, tools, or processes, wherein every organization has attempted to protect its claim to work which it has previously done, while other organizations have attempted to assert claims based upon the type of materials used, the tools used, or the nature of the work. Less extensively publicized, but perhaps more bitterly denounced, have been the jurisdictional claims of skilled crafts for work that could be done by unskilled workers and for work that, in nonunion jobs, is usually done by unskilled workers

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[20] In 1920, the *Census of Occupations* reported 24,572 building trades apprentices; in 1930, 16,623, a reduction of 32.3 percent. Between the same years, the number of skilled workers in the building trades increased from 1,911,380 to 2,379,149, an increase of 24.5 percent.

at rates of pay equal only to one-third or one-half of that demanded by the skilled workers. A notable case of this character involves the claim of the painters for the work required in moving scaffolds and canvasses, and cleaning paint spots resulting from their work.

The unions usually rationalize these regulations in terms of such arguments as: the protection of health against overspeeding; the avoidance of respiratory diseases from the use of the spray gun, or the protection of older workers from the competition of younger and more efficient workers; the protection of the quality of work or the protection of the skill of the craft; the avoidance of dangerous work practices or the meeting of hazardous conditions with the presence of a sufficient number of adequately trained workmen; preventing the employer from using "bellwethers" or leaders who, usually for a privately paid extra compensation, set high standards of productivity against which the accomplishments of all workers can be measured, and by means of which employers frequently attempt to force reductions in wage rates on the basis of the claim that the men are substandard workmen. Most of these claims of the unions have some justification, but it is probably fair to say that many of their arguments lack substantial validity and that, in any case, practically all of them avoid the statement of the basic reason for the development of restrictive regulations.

The basic reason for the development of restrictive regulations by the labor unions lies in their desire to protect the worker's income status and job security and to protect the professional prestige which is vested in the skilled workman because of his mastery of the craft. As has already been pointed out, the status of the building trades worker is one of great and constant insecurity. It is not unexpected that, with the introduction of any innovation in the building trades processes, a worker whose status is already insecure should immediately examine the innovation to see what further elements of insecurity it brings to him. Every innovation arouses the worker's fears concerning its possible consequences, even in cases where he cannot reasonably see any dangerous consequences to himself. It is his reaction, therefore, to oppose any innovation the results of which he cannot entirely foresee, and to oppose every innovation which appears to forecast an increase in his insecurity.

These considerations, however, do not constitute a justification of practices which increase building costs. They constitute justifications of protective devices only to the extent that such devices are made necessary by the usually hazardous practices of the industry itself. To the extent that these restrictive practices of the unions cannot be justified by considerations of health and safety, the economy of the industry demands not only their elimination, but the elimination of the conditions which called them into being.

If the construction industry and its labor forces could be so organized as to guarantee reasonable job and income security to all of its members, the ever latent opposition to innovations would be greatly diminished. If innovations did not raise fears of greater insecurity, there would not be new restrictions to govern more efficient processes. If, with every innovation, an understandable guarantee of the protection of the interests of the workers was provided, the only basic obstacle to its introduction would lie in the traditional inertia and habits of the group, which can be overcome. Each of the restrictive limitations outlined above can easily be analyzed as an attempt on the part of the organized group to protect its job security and to improve its income position. If and when a program involving new processes of construction as one of the considerations in the development of greater job security and improved income status for a considerable mass of the building trades workers can be offered to the construction industry, it is reasonable to expect that, after consultation and negotiation, it would not be difficult to secure the cooperation of the labor groups in the development of the program.[21] At any rate, it probably can be forecast that the readiness of the labor group to accept and cooperate with such a program will, at least, be no harder to secure than the acceptance by and cooperation of the interested business groups.[22]

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[21] Instances have occurred in which operative builders have undertaken such negotiations with union groups and secured their sympathetic cooperation in private low-cost housing programs.

[22] The restrictions discussed above are not to be confused with racketeering, which is sometimes charged to the building trades unions and which is sometimes discussed by writers on housing problems as a major characteristic of the organized building trades. Bona fide efforts to maintain observance of established labor conditions, by means of strikes, boycotts, sabotage, and fines imposed on workers or employers, must be clearly distinguished from the imposition of fines for the personal enrichment of the business agent (with, perhaps, a cut for the union treasury), and from strikes or other tactics to injure one employer in return for payments or favors from other employers. Recurrently, in a few large centers, a few business agents who adopt racketeering policies reach positions of leadership. Such instances, however, are definitely isolated, and it is quite unfair to charge that they are representative of building trades unionism.

Studies of such racketeering have indicated that it has developed when clever, but not too scrupulous, men have achieved local union leadership. They have been men who were able to secure desirable working conditions for the union members. As business agents, they were successful; and as a result, the membership was willing to condone their practices, as least until such time as public pressure or their overreaching abuses began to injure the union's standing. In all cases, however, they have been able to operate only with the tolerance of most of the contractors, and usually with the connivance of many of them. Under certain conditions, cooperating contractors are able to secure definite advantages over their competitors, and in some cases, can increase their commissions from the owners.

In general, it is the nature of the organization of the industry that makes racketeering possible. Reorganization of the industry, with the elimination of the subcontracting arrangements which dominate it, would tend to eliminate the possibility of the development of racketeer leaders.

Unfortunately, the attacks on building trades union racketeering usually emanate from bitterly anti-union sources. As a result, both union members and national union leaders tend to discount the charges and to defend the unscrupulous local leaders. The amount of misrepresentation that has occurred, tends to justify their position. Sometimes, also, internal union politics makes it difficult for them to act, even in acknowledged cases of racketeering leadership. If attacks on racketeering were not so often spearheads of attacks on unionism as such, the unions would be much less hesitant about cleaning their houses when they are found out of order. No considerations, however, can justify racketeering practices, or the tolerance of racketeering leaders by union organizations. Sound public policy, as well as best union interests, call for aggressive action by organized labor as well as by all other bodies, to eliminate the racketeer whenever and wherever he makes his appearance.

The Influence of Governmental Planning and Policy

Economies from Stabilization

For the immediate future, the primary economies that may be effected in the construction industry with regard to labor costs must, it appears, be the result of the development of building programs and the adoption of coordinated policies by governmental agencies. The chaotic nature of the organization of the residential building economy at the present time is such that a reorganization along more rational lines can be effected only over a period of years. The primary factors through which a reduction of labor costs may be secured are: a decrease in the hourly wage rates, and an increase in efficiency of the utilization of the workers' services.

Reductions in wage rates will be attractive to workers only when sufficient guarantees of full time employment can be made to supply adequate annual incomes. The provision of full-time employment has been considered to be dependent upon overcoming the difficulties of operations during winter seasons.[23] In a large part of the country, of course, the winter seasons do not offer serious obstacles to the continuation of the construction work. In the States of Florida and California, however, the seasonal variations in construction employment are almost as great as the seasonal variations occurring in States along the northern border. Even in States which suffer severe winter seasons, new processes have made winter building economical when slight financial incentives are offered to overcome the cost of artificial heating and other arrangements.

In a number of Federal housing projects prosecuted during recent years, the winter seasons appear to have offered insignificant barriers to the continuation of construction work. In many cases, the winter seasons appear to have had little effect upon the numbers of workers employed. Most reports indicate that the winter season offers a serious obstacle only with regard to the completion of concrete work. Reports of one agency indicated that, if foundations were completed before the first freeze, work could be continued with interruptions only for severe cold spells of short duration.

More important than overcoming the periods of seasonal unemployment is the problem of insecurity which results from the dependence of the workers upon the occasional or haphazard demands of an indefinite number of individual contractors. This problem results particularly from the small-scale basis upon which most of the construction idusntry of the United States is erected. With building operations in every community conducted by a large number of builders and small contractors, no employer is in such a position that he can undertake to give employment for any considerable length of time to any individual worker. Each contractor and subcontractor completes a contract within a few weeks' time. His employees must then shift for job opportunities with other contractors. As a result, there is a well-recognized tendency for workers to slow down as any job approaches completion, and particularly, as the winter season approaches. There is, furthermore, a deterioration of skill over the winter season and especially after a longer period of unemployment. The accompanying discontinuity of employment also has led workers to demand higher hourly wage levels.

If residential building and the construction industry in any locality were concentrated in the hands of larger-scale operators who, in turn, were able to carry on their building activities on a larger scale, it would be possible for each contractor to employ his workers on a more continuous basis. Because of the larger-scale operations on each contract, a longer period of employment would be provided to the workers on each job, and it would be possible to shift them, in planned sequences, from job to job under the same contractor. The highest degree of employment stabilization, however, will probably not be obtained until there has been a vertical reorganization of the construction industry; this would tend to result in the displacement of current subcontracting arrangements.

Progress toward stabilization of employment has been made in many communities in the absence of the development of large-scale building promoters and contracting firms. Through cooperative operations of contractors, the available local supplies of labor have been pooled and distributed through a central clearing house; a more even distribution of employment among the whole force and greater continuity of employment of individual workers has been the result. This function is usually performed by labor unions; in at least one case, however, a similar arrangement was made by non-union contractors.

Eventually, the construction industry may be reorganized on a basis which will enable the individual employers to employ their workers on the equivalent of an annual salary basis. When so reorganized, with adequate capital and able to plan its production program over a period of years, the construction industry will find it possible to develop wage relationships with its employees, which will greatly reduce the labor costs of construction operations.

Pending such developments, it may be possible for the federal government, under the U. S. Housing Act, in conjunction with local housing authorities, to undertake long-range planning of large-scale residential construction, either by force account or by contract, subject to limitations which could provide continuity of employment to individual workers. Such guarantees of continuous employment should be made contingent upon agreements with responsible working forces for concessions in hourly wage rates in return for higher annual incomes.

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[23] The local institution of "leasing dates" has also been mentioned as an obstacle to continuous building employment. The history of the construction industry indicates, however, that "leasing dates" evolved from the practice of concentrating residential building in the summer months. The development of year-round building activities would tend, of itself, to break down the institution of "leasing dates."

Such a proposal would not be entirely new to the industry or to building trades unions. Several unions maintain differential rates for maintenance employees engaged on a monthly or annual basis. They have often agreed to the employment of foremen and other supervisory employees on a monthly basis, and there are a few recorded cases providing for employment of construction workers on annual salaries. Building trades workers have no objection to such arrangements, as such. They justifiably want to know, however, that the plans for annual payments are made in good faith, will be honestly adhered to, and, in the absence of general acceptance, will not embarrass them in maintaining wage scales developed for an industry operating on another basis.

Governmental Influence and Stabilization

The recognition of the need for stabilization of the construction industry in order to obtain reduced building costs is not new with this report. It has been the subject of several studies made heretofore. Previous studies, however, have been based primarily upon consideration of private building enterprise only, and it is only within the last few years that there has been any substantial agreement that government held any responsibility with regard to housing. With the acceptance of the principles of governmental responsibility, as evidenced by various legislative acts, the problem poses itself as to whether or not government should take cognizance of the instability of the industry and attempt to encourage its reorganization. Government, in any case, is confronted with an opportunity to direct its activities in such a way as (a) to stabilize that portion of the industry which engages in the erection of buildings under governmental influence, and (b) through demonstrating the possibilities of stabilization, to influence thereby the much larger portion of the industry which remains entirely under private operations. If government fails to make the most of this opportunity to assist in the stabilization of the construction industry, it is likely that progress towards this end will be delayed for several decades.

If government agencies accept the responsibility of attempting to influence the building industry towards stabilization, those agencies must accept such a principle as one of their primary responsibilities, and make it a part of their philosophy, policies, and general program. To effectuate such a policy, the responsible agencies should plan their operations on a large-scale basis. The location of projects should, in part, at least, be determined by conditions of employment prevailing in the communities. The initiation of the several projects in any community should be timed in such a way that relatively continuous employment could be provided to given numbers of workers.

Haste in developing projects would have to be made subordinate to other considerations. The general program, first, would have to be planned in terms of the continuous employment to be afforded. Careful plans for building would have to be developed, based, among other things, upon the types of labor available in the communities. Scheduling of operations by the builder in order to fit the several crafts into a program of continuous work would follow. Finally, the delivery of materials would be scheduled to fit the work program. Deadlines for initiation and completion of work would be determined, on a flexible basis, in terms of employment arrangements.

To accomplish the most effective results, it will be necessary to secure the understanding cooperation of all private parties involved in the program. The agencies cannot depend upon a general acceptance of their policies by other parties, if no specific effort is made to outline the bases of operation, and to secure the voluntary acceptance of these bases and of the principles of operation founded thereon, unless there has been consultation with the private parties in advance. It is particularly important that the organized building trades unions should be consulted concerning these plans, their advice requested, and their assistance sought in the execution of the programs of the agencies.

Once the policies have been agreed upon, the execution of operations within their limits must be secured. This means that the contractual relationships of the government agencies with all private and public parties concerned—municipalities, contractors, labor organizations—must be expressed in terms of the general policies; that is, insofar as construction is undertaken by contract, the contractor and the organizations with which he deals must be bound to operate within the program.

The agencies should be left free to adopt such programs of execution as will permit fullest adherence to the stabilized program. In many respects, the prosecution of their work by force-account methods will have advantages over prosecution by means of contracts with private builders. The experience of the last few years has not proved the superiority of the force-account method over the contract method or vice versa. The peculiarity of the conditions surrounding much of the work done by contract and surrounding all of the work done by force-account methods has been such as to make valid conclusions impossible. While the contract method throws the onus of financial risk upon the contractors, unless contractual provisions are carefully developed, it may fail to give the best results from the point of view of stabilization. The force-account method of construction should not be used, however, unless it is adopted as a long run principle and unless an adequate organization of relatively permanent personnel, selected with regard to qualifications and carefully trained with regard to the employment features of the program, is developed.

In conclusion, it would be appropriate to point out that the experience of the last few years does not provide a sufficient criterion for judgment as to what might be done with a carefully planned and well executed building program, either with regard to the possibilities of stabilization or with regard to costs. The programs of the last few years have been compounded with many other objectives and conditions, such as: the employment of persons on relief, the distribution of purchasing power, assistance to private contractors, aid to the heavy industries, experimentation with new building materials, relief to mortgage holders and finance houses, influencing interest rates, resettlement of population, and conflicting ideas concerning residential construction.

VI. BUILDING REGULATIONS AND THE HOUSING PROBLEM

By George N. Thompson[1]

The primary objective of building regulations and codes is to protect the public against injury, disease, and death. Any proposal to make a saving either in time or money by abrogating or modifying building regulations or codes may result in a final economic and social cost that is incalculable. Any economies sought within our extant building regulations should be carefully considered by technicians and experts who are entirely disinterested and impartial.

Building Regulations and the Construction Industry

No housing is worth while if it is unsafe or unhealthful. This would seem to be an elementary statement of fact requiring no elaboration. Yet there is considerable misunderstanding of those legal measures known as building regulations through which communities seek to assure safe and sanitary conditions.

There are two approaches to this problem of building regulations—the disorderly process and the orderly process. The disorderly process is characterized by sporadic outbursts of criticism, usually not substantiated by evidence, to the effect that regulations are hampering progress in the construction industry or that they are deficient in their requirements. The orderly process is characterized by continuous study of disease, injuries, and loss of life due to faulty buildings, by systematic testing of structural materials and building equipment, by development of standards of quality and of performance, and by preparation of minimum requirements incorporating the best obtainable expert judgment.

The disorderly process proceeds as a rule from two reactions. The first is impatience with some existing requirement because it is believed to be unduly restrictive. The second is an emotional response to some great disaster, such as a conflagration or a major loss of life. The first insists on lowered requirements and the second on drastically increased ones. The orderly process recognizes that there may be justification for each attitude but that yielding too much to the demands of one may produce the undesirable conditions criticized by the other. For example, existing fire protection requirements may be felt to increase the cost of construction beyond reason, but relaxation too far may expose building occupants to the horrors of fire, with subsequent remorse on the part of those who advocated letting down the bars.

The orderly process is aware of the complicated and delicate adjustment necessary to achieve balance in protecting the public without discouraging construction. It seeks to act constructively in production of more rational requirements. Unfortunately, the fact that it is operating continuously is often unknown to those who periodically rediscover the admitted fact that there is still room for improvement.

This discussion is presented with the object of creating a better understanding of the fundamental nature of building regulations and of their impact on the construction industry. It recognizes the value of the disorderly process as a stimulant which rouses public interest and tends to prevent a too deliberate attitude towards desirable changes. However, it lays stress on the orderly process which has to accept the responsibility of determining, in the light of research and of experience, just how far it is possible to modify existing requirements without danger to life and limb.

The Regulatory Function of the State

We may start out with the assumption that a building is a complex structure, the product of many minds and hands, and rising in the midst of an imperfect world. Skilled design, complete knowledge, adequate supervision, perfect materials, and competent workmanship, supplemented by absence of selfishness and by nobility of motive may all combine to produce a structure that is irreproachable. But knowing human nature as we do, we are forced to conclude regretfully that some one or even all of these factors may be missing and thereby afford a chance for flaws to creep in. To the extent that these flaws are a menace to human life and limb they are a matter for attention by the State, which possesses the police power to control them.

What actually happens in the great majority of cases in this country is that the several States transmit their power to the municipalities either by enabling acts or by provisions in city charters. The municipalities proceed to adopt regulations designed to protect their citizens. These regulations are of several kinds and constitute a network of restrictive requirements concerning buildings which covers the country, although not with a perfect pattern. There are gaps where municipalities have failed to exercise their power or have done so in a very sketchy manner. There are areas where incorporated municipalities do not exist or are far apart, leaving the intervening space to be governed by State or county regulations or by no regulations at all. So, when we speak of building regulations, we do not refer to a system of requirements that reaches into every hamlet.

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The different kinds of regulations that affect housing vary in title and scope, but the chief elements are as follows: (1) The building code, (2) the zoning ordinance (3) the housing code, (4) the electrical code, (5) the elevator code, (6) the plumbing code, and (7) the boiler code.

This does not exhaust the list of legal requirements. There are fire protection ordinances, health ordinances, and other measures designed to cover special aspects of protection for the public. He who builds a house is indeed hedged about with restrictions that range all the way from how high he can go to what size windows he shall use and what kind of electrical switches he may put in his bathroom. For each requirement there is a reason. It may not always be apparent, but it is there, and he profits or suffers depending upon whether the reasoning has been good or bad.

The building code customarily deals with the erection, alteration, repair, demolition, and maintenance of buildings and other structures. Its purpose has already been indicated. The zoning ordinance seeks to bring under control the casual and unrelated growth of construction in a municipality so that nearby structures will have a harmonious relationship. It deals chiefly with height, use, and area. The housing code, less frequent, but equally important where effective, seeks to regulate conditions of light, air, and sanitation in residential buildings so that healthful conditions will be obtained. Maintenance bulks largely in its program. The electrical code regulates wiring and fixtures with the object of minimizing fire hazards and risk of shock. The plumbing code aims to bring potable water to the house, conduct it without contamination through its appointed course, and lead it away bearing its load of body wastes so efficiently that no menace to health results. The elevator code is put in force to guard against accidents peculiar to this item of building equipment. The boiler code governs the conditions of construction and installation of boilers to prevent explosions.

Is Regulation Necessary?

It has been said that the State has the right to protect its citizens through these documents but the question may be raised whether their existence is really necessary. The answer to this comes from experience. The great fires of Chicago, Boston, Baltimore, Atlanta, and so on are convincing evidence that precautions must be taken to prevent enormous losses not only in property values and in dislocated business life but also in heart-rending privations, personal injuries, and loss of human life. According to the Bureau of the Census, 7,874 lives were lost in the year 1935 as a result of conflagrations and burns, the majority in homes.[2] Catastrophes like the collapse of the Knickerbocker Theater Building in Washington in 1922 where about 100 lives were crushed out, and the recent occurrence in New York City where 18 lives were lost as the result of the collapse of imperfectly supported masonry are but examples of a long list of occurrences that justify constant vigilance with respect to building construction. Of late years we have become increasingly conscious of the insidious effects of inadequate provision for light and air in designing buildings. We have come to accept it as a fact that a healthy race needs to be surrounded with safeguards in this respect when construction is proposed. The roster of broken lives and fortunes and of lives snuffed out as a result of wrong building practices is a powerful argument in favor of regulation.

Yet a building is a static body which seems to present few possibilities for doing harm. Unlike the automobile, it possesses no ability to collide with its fellows; but in it, either for purposes of working, sleeping, recreation, or otherwise, the human being may spend as much as 20 hours a day on the average. The force of gravity, the phenomenon of combustion, the life cycle of microscopic plants producing disease need only the right conditions to act and bring about a dangerous situation.

Added to this is the problem of adjusting relationships between owners of nearby buildings fairly so that some owners will not profit at the expense of their less enterprising or more considerate brothers. Take the case of several city lots all located in the same neighborhood. Owner A might theorize that he should be free to build as he pleases and undertake the erection of a 20-story building. Owner B protests that this will deprive his building of light and air, while the city fire department advances the point that its apparatus will have great difficulty in controlling a fire in a building of such height and of the proposed type of construction. Who is to say how these clashes of interest are to be adjusted? Obviously, if justice is to prevail, the community acting as a governmental unit must decree what is a fair use of A's land.

The principle goes still further. Into A's building will come all manner of men, each bent on his separate errand, and few having the training to judge whether they are subjecting themselves to danger. Will the building collapse under the weight of the materials permitted in it? Will a blast of flame sweep through its corridors and trap the hapless tenants? Since it is not simply a question of A's personal safety but of the safety of the hundreds who come at his express or implied invitation to his door, some agency must act in the interest of all. This agency is that of government, which is set up for the purpose of dealing with just such questions.

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[2] Not all this loss of life resulted in burning buildings.

These illustrations may seem trite, but it is surprising how often a reminder must be given that conditions of urban life require the giving up of a certain part of liberty of action in the interest of the greatest good for the greatest number. Many requirements for building regulations that are now accepted as a matter of course were fought bitterly when they were proposed, largely because of lack of understanding of the fact that the time had come to exercise restraint.

Regulation and Technological Change

Perspective is needed if we are to judge fairly the relationship that exists between restrictive requirements and the construction industry. For centuries, construction was of a simple basic type that made use of generous amounts of material to compensate for ignorance of stress and strain values. With the coming of the industrial revolution in the nineteenth century, however, inventions began to appear that were destined to have a profound effect.

When the idea of carrying all loads on a structural steel frame was put into execution and the first skyscraper was born, there started a series of events that is still in action today. We are told that the manufacturers of wrought-iron shapes opposed the introduction of steel for this purpose. Indeed, the Bessemer steel of the early days was none too reliable a material. The boldness and simplicity of skeleton construction were too attractive to be denied, however, and so it gained in favor. Much had to be learned. Structural shapes had to be devised and methods for rolling them perfected. The physical properties of these shapes had to be determined and handbooks issued. Here was a case of an industry suddenly developing a vastly increased use for its product but with very little background upon which to formulate a reliable set of rules of use.

Again, take reinforced concrete, which came into prominence at the turn of the century and has grown in importance ever since. The realization that concrete and steel would bond together so that the one could take care of compression and the other of tension opened up a fascinating vista of usefulness. Here, another vast industry was born, obliged to probe continuously into the facts about its product and prove its advantages to a doubting world.

These are examples of cases where inventive genius supplemented by modern industrial organization has profoundly affected the problem of public protection. A whole new series of concepts has had to be accepted. Proof has had to be required to substantiate claims. The volume of specific legal requirements has been greatly increased and methods of inspection have had to be adapted to the peculiar characteristics of the new order. The cost to the municipalities has increased because of the necessity of covering a great variety of matters that once were unknown. Such increases in municipal expense are the price of progress in the industrial world, a fact not always appreciated by critics of growing municipal budgets.

At the same time, the industries that have grown up have found that their problems were not limited to those of production and distribution. A third element, regulation, has stepped in. They have been told that their product must be used only in such a way and in such amounts, that the community will demand that they maintain such a quality, and that failing these requirements the use of their products will be restricted or even denied completely.

Elsewhere in this series of reports will be found statistical material showing the great volume of business growing out of the needs of the construction industry. Anything that tends to restrict the use of the products thus made available may be reflected in reduced opportunities for workmen to make a livelihood and for business concerns to benefit from their enterprise. There is no room in the code-making process for thoughtless and prejudiced action. It is thus a heavy responsibility which falls upon those who develop building regulations. On the one hand is a consciousness of the possible effect on industry and employment. On the other is the knowledge that such considerations must yield to the paramount need of safety when necessary and that safety is a matter to be determined not by claims but by proof.

This is the lesson that must be learned sooner or later by every proponent of new building materials—that the public can not tolerate the indiscriminate use of such products but will expect proof of their safety. Modern industrialists understand this and do not object to submitting to tests in disinterested laboratories where the characteristics of their products can be fully ascertained.

Building Codes and Building Costs

What industrialists do object to, and rightly, are the inconsistencies and abuses that are to some extent present under the existing system. They find that local codes vary in their requirements, sometimes resulting in the necessity of altering manufacturing processes to meet local requirements and thereby causing the loss of much of the advantages of mass production. More serious in their moral implications are charges that worthy new materials are excluded because interested organizations are sufficiently influential to control the regulations. In either case, not only the industry affected but the general public suffers, for a limitation on the freedom of choice of materials inevitably reacts on building costs.

The two most serious charges heard with reference to the effect of building regulations on industry are (*a*) that they increase unduly the cost of construction and (*b*) that they hamper unnecessarily the introduction of desirable new materials and methods of construction. There is some truth in these charges and also considerable exaggeration. Let us first examine the matter of construction cost.

The cost of a house is made up of a number of factors. There must first be land upon which to build it, but we will exclude consideration of this except for calling attention to the fact that it may constitute a fifth part of the cost of the project and is little affected by building regulations. The cost of the house itself is dependent upon many factors, among which are the following:

1. The efficiency of the design.
2. The prices paid for structural materials.
3. The amount and quality of structural materials.
4. The wages of labor.
5. The efficiency of labor.
6. The elaborateness of the equipment, such as heating, plumbing, electrical work, etc., again affected by material and labor costs.
7. The elaborateness of trim and decoration.
8. The architect's fee and contractor's profit.
9. The efficiency of supervision.
10. The general overhead expenses.
11. The cost of financing.
12. The cost of local transportation.
13. Topography and soil conditions.
14. The cost of providing utilities.
15. The effect of weather conditions during construction.
16. Intangible factors such as competitive conditions in the local building industry.
17. Building regulations.

Such factors interact in different ways, so that the cost of a house may vary as much as 50 percent in different localities. It is difficult to segregate the effect of any one factor. Indeed, there have been many loose statements about the effect of certain factors on costs. The best that can be done in the case of building regulations is to compare what is required in a given case with what we believe would fulfill all the necessities of safety and health, to see if there is a difference and of what mathematical sign. For not all desirable changes in building regulations will operate in the direction of saving.

At this point it will be necessary to narrow down the discussion to building codes as distinguished from building regulations. Different kinds of building regulations have been enumerated because they are closely related and sometimes confused. It not infrequently happens that criticism of "building codes" is found to relate to some type of regulation not customarily found in such codes. Broadly speaking, building codes are primarily concerned with requirements for strength, fire resistance, exits, and certain features of sanitation.

Building materials, such as wood, concrete, brick, and steel, have different abilities to sustain loads. Some are tough. Others are brittle. We learn from tests and experience about what they are capable of doing and specify in building regulations what qualities and sizes are necessary to hold up the known loads. So we require in codes that enough materials shall be used in order to insure safety. Sometimes, this is done directly by specifying how thick walls shall be, and so on. Sometimes, it is done by giving certain assumed strengths per square inch for materials and leaving the determination of size to calculation. In whatever way it is done, it is clear that in setting arbitrary minimum amounts of materials to be used, the cost of the structure is affected.

As with requirements for strength, so with those for fire. Certain thicknesses of protective materials are required to keep structural members from collapsing when exposed to heat. Incombustible material has to be inserted at strategic points in frame walls to block off the spread of flame. Chimneys and fireplaces have to be made with walls of certain thicknesses and kept away from combustible construction. Heating appliances have to be properly isolated. Here, again, it is plain that "economies" can be effected by reducing amounts of materials used, cutting down clearances, and so on. But the fine line has to be established beyond which such practices will cause the protecting materials to lose their effectiveness.

There are three courses open to industry when representations are made that code requirements call for use of more material than is necessary to meet the needs of safety. The first is to throw the influence of the industry behind retention of the existing requirements on the theory that a reduction in the requirements would be followed by a corresponding loss of market for the material concerned. The second is to adopt the attitude that the matter is one lying more in the realm of engineering than of commerce and should be decided on an engineering basis; the view being taken that, in the long run, a reduction in quantity of material used on individual jobs will bring about reduced costs, thereby stimulating more building and actually resulting in a broader market than formerly. The third is to advocate even more liberal reductions than have been proposed on the theory that the material suffers a stigma if it is granted anything less than it is capable of showing under the most favorable circumstances.

It requires a broad and statesmanlike attitude to distinguish what should be done in the public interest as contrasted with the immediate advantage of one group. The situation is complicated by the fact that different types of construction meet on a highly competitive plane where a slight reduction in the required amount of one material may be sufficient to induce a prospective builder to change to that material from one which he had hitherto favored. This situation partly accounts for the fact that today there is relatively less insistence on retaining excessive amounts of material and more of a disposition to favor the least amount of material that will do the job.

The result is that allowable working stresses are being generally increased. Obviously, there is a limit to this process. Although it is fashionable in some circles to decry the term "factor of safety," there will always be need for allowing some margin between what is required and the point where the material as assembled fails to perform its function. Some constructions are more uniform in quality and put together with better workmanship than others, but none can be said to be absolutely unvarying in their ability to do what is expected of them. A building is still the product of many minds and hands, and perfection from each is beyond the lessons of human experience. So as the margin between safe and unsafe practice is pared down, the possibilities for further competitive advantage in this direction become negligible. Knowing where to stop, at the point where there is still a proper allowance that will prevent failures and consequent set-backs for the industry concerned, is most important in the long run. As the margin becomes slimmer and slimmer, the advice of the completely disinterested engineer assumes greater significance.

It is sometimes thought that changes in building codes will always operate in the direction of economy. Such is not the case. A thorough overhauling of a code may result in savings in one respect and increased costs in another, with the possibility that the one may cancel the other.

To illustrate, take the matters of working stresses in structural materials as against light and ventilation of buildings. It is more than likely that an examination of the average code will disclose places where higher stresses could be permitted under conditions of skilled design and construction and that this would result in a reduction in building cost. On the other hand, the average building code is apt to reflect the ideas of a score of years ago when it sets forth minimum sizes of courts and yards, and similar matters. Those who have studied the subject of land coverage are well aware that there is a law of diminishing returns in crowding the land, but up to a certain point—certainly up to the limits permitted in the average building code—there is a saving accomplished by keeping court sizes small if by saving is meant getting the maximum amount of rentable space for a given expenditure for land and building. There is a clearly discernible trend in public policy toward discouraging this practice, however, not because the change will reduce the cost of construction, but because it will produce living conditions more nearly in accord with what we believe is right today. Here are instances where, on the one hand, a reduction in cost may be made and, on the other, an increase.

Instances could be multiplied. Take the case of fireproofing. As a result of more intelligent appreciation of how much fireproofing is necessary for a given set of conditions, required thicknesses can be reduced from those found in many codes. On the other hand, the building of structures estimated to last as long as 60 years and greater concern for the safety of tenants are held to require fireproof construction in instances where it was not required before. In the one case, a saving is accomplished, and in the other, a considerably greater expense than formerly is incurred, all for perfectly logical reasons.

Again, the iron fire escape allowed by many public authorities is on its way to oblivion, convicted of being a false device upon which to rest hopes of escape from a burning building. In its place is coming the enclosed stairway protected by incombustible walls and doors—at, of course, greater expense. As partial compensation, is a growing belief on the part of some designers—although sanctioned as yet to a very limited extent in codes—in the sufficiency of a single enclosed stairway in fireproof buildings of limited height and occupancy. If permitted, this practice not only saves the cost of constructing the customary second stairway but provides additional rental space where this stairway would have been located. Again, two types of changes, both probably in the nature of improvement, would have directly opposite effects on building costs.

Even though no money savings whatever were possible, there would still be a need for rationalizing requirements. There are other savings of a more intangible nature which are important. One, of course, is the saving in human life and suffering through more effective safeguards that have been developed in the light of increased knowledge and experience. Another is the saving inherent in greater freedom for designers where this can be granted without sacrifice to safety. Until a plan is actually started, it is difficult to visualize what the effect of a given requirement will be. As the outlines are sketched in, however, it becomes plain that not only the choice of materials but the shape of the building, the arrangement of rooms, and the general efficiency of the plan are held within certain limits. Sometimes these limits are too rigid, preventing the most intelligent solution of the problem and discouraging the exercise of that ingenuity which is so essential in connection with low-cost housing.

Thus far we have examined effects of building code requirements on building costs. We have observed that these requirements are one of a large number of factors affecting costs and that, through changes, some cost reductions should result, but that other desirable changes may offset these reductions to a greater or less extent.

Building Codes and New Materials

Another charge made against building codes is that they interpose a wall before desirable new forms of construction and prevent these forms from conferring their benefits on the public.

This is a serious charge. If there is anything that is patent today it is that flexibility in adjustment to changing conditions is worth while. It is to be taken for granted, however, that these new forms of construction should be ready to prove that they are safe and will remain so.

Exactly what is the situation? This can be determined roughly by taking a sample of codes now in existence. The method in vogue, where the matter is mentioned, falls into four classes. In the first, full authority is vested in a local board to approve or reject the material or construction. In the second, full authority is vested in the building official. In the third, the building official has the authority but adverse decisions are subject to review by a board. In the fourth, an amendment may be recommended to the code by an official or board after suitable investigation.

It appears from a study of building codes that in many cases no change in the code is necessary to pass upon a new material or construction. In these cases, the code cannot be blamed for blocking its introduction. What is probably giving rise to complaints is the lack of adequate machinery to carry the terms of the code into effect. A building official or board needs several things to be able to come to a just conclusion. One is a series of standard test methods by which the proffered construction may be subjected to rigorous proof of its claims. Another is the availability of suitable test machines operated by completely disinterested agencies. A third is protection from political or other pressure which would tend to influence the completely impartial nature of the proceedings. In some cases, the officials concerned must also satisfy themselves that there is a supply of qualified workmen who can be trusted to install the material in the proper manner. This involves some system of examination and licensing.

For the codes that make no provision for dealing with new developments in construction, there can be little excuse. As promptly as possible they should be altered to provide for the systematic investigation of claims and impartial treatment.

Low Standards for Low Incomes?

It has been said that the imperfections of building regulations are periodically rediscovered. This is true in the housing field as well as elsewhere. It has resulted in some constructive suggestions and also in some evidence of misunderstanding of the nature of such regulations. The suggestion has even been made that special exemptions from code requirements be allowed for the benefit of low-cost housing, either by passing a special code of building requirements for the benefit of this particular type or by specifically excluding such housing from the operation of the code. It is worth while to ponder over these proposals.

Let it be remembered that the purpose of building regulations is to protect against injury, disease, and death. Proposals to make special dispensations for the benefit of low-cost housing are a way of reducing the degree of safety required for those of low income below what is enjoyed by those in better circumstances, although this does not seem to be fully realized. Such a discrimination against the less fortunate, made in the name of reduced costs, introduces a principle foreign to our democratic concepts. Although put forward with the best of intentions, its effect would be to create a stratification of degrees of safety imposed by the State.

What is probably intended is that all building code requirements for residential construction, of whatever character or cost group, should be subjected to critical analysis to see whether legitimate economies can be suggested that will not jeopardize the building occupants. Such a proposal has merit although the possibilities disclosed are likely to be moderate in character. This is partly so because the same proposal was made and somewhat the same ground covered about 15 years ago. At that time, the country was emerging from another depression, and a shortage of homes was becoming acute. Building regulations were criticized for requiring excessive amounts of materials, thereby raising costs and contributing to the existing difficulties. A committee of experts known as the Department of Commerce Building Code Committee made a special study of the matter and issued recommendations permitting considerable economies as compared with the then existing practices. These recommendations were widely used as local codes were revised and were responsible for significant savings. A revised edition of the recommendations was issued in 1932. Events have moved so rapidly in the construction field that further refinements may well be possible. It would seem wise to build upon this past work, however.

If there is anything wrong in a particular code, the proper procedure is to demonstrate the fact beyond argument and bring about a change that will extend its protective influence equally to all citizens in the community.

Reflection will bring out that a requirement is held to be wrong because the critic thinks it is so. If the critic is competent technically, and others equally competent and disinterested agree with him, the odds are that his position is well taken. Even then, in a matter which involves personal safety, the thoughtful critic will wish to check his judgment by consultation with those who have made a special study of the subject.

Analysis of building code provisions will disclose that they consist partly of matters of fact and partly of matters of opinion. That a masonry wall of given characteristics will, on the average, break at a certain load is a matter of fact that can be demonstrated in the laboratory. That a factor of safety of four should be applied to take care of variations in such walls as actually constructed is a matter of opinion. That a blank wall erected several stories in height close to a lower building will cut off a proportion of the light of that building is a matter of fact. That setting the wall back a distance equal to the height of the affected building will provide a proper amount of light is a matter of opinion.

So it comes about that the ingredients of good building code requirements are facts, established by research, tests, and observation, and judgment as embodied in a consensus of men possessing adequate training, experience, and discrimination.

Sources of Technical Information

For facts, we turn to research institutions, such as the National Bureau of Standards, the United States Forest Products Laboratory, the Underwriters Laboratories, laboratories of state universities, and other agencies. For judgment, we can draw on the scientific and professional societies, such as the American Institute of Architects, the American Society of Civil Engineers, standardization bodies such as the American Society for Testing Materials, the American Standards Association, the National Fire Protection Association, and similar organizations. By following this procedure we can eliminate, so far as is humanly possible, those proposals which arise out of individual eccentricities or selfish motives and arrive at basic requirements worthy of universal respect.

The serious efforts that have been made and are being continued with the object of providing more scientific building regulations should be better known. Mention has already been made of the Department of Commerce Building Code Committee. This body, composed of nationally known architects and engineers, was in existence for 13 years. It functioned in connection with the National Bureau of Standards which furnished its staff and performed a great deal of necessary research. Whenever a situation was encountered where it appeared that opinion could be replaced or at least made more rational by fact, the committee endeavored to bring this about. For example, it found that loads due to furniture, equipment, and so on, were assumed to have certain values in particular occupancies and that these assumptions varied widely. The simple but homely expedient of weighing such material in typical occupancies was resorted to. In the case of plumbing, the National Bureau of Standards was asked to undertake an elaborate series of experiments which pointed the way for reduction in pipe sizes and elimination of certain customary features, thereby making it possible to suggest requirements that would make plumbing less costly. Reports containing recommendations were issued on small house construction, on masonry walls, on live-load assumptions, on working stresses in building materials, on code arrangement, on fire resistance, and on exit facilities for buildings. To a greater extent than had been the case hitherto, these recommendations represented that blending of scientific fact and expert judgment which is essential to good requirements. More than 350 municipalities and several States have made use of them in preparing or revising building regulations.

The successor to this body is the Building Code Correlating Committee of the American Standards Association. Continuity in building-code work is provided through acceptance by this later committee of the recommendations produced by the earlier body and by definite arrangements for bringing recommended code requirements abreast of modern thought as the need arises.

Under the procedure of the American Standards Association, the National Electrical Code and Safety Code for Elevators, Dumb-waiters, and Escalators have achieved national acceptance as the basis for local requirements. There is no reason why basic building-code requirements should not be similarly evolved, given an open mind and a disposition to cooperate on the part of those concerned.

The thought behind the procedure of the association is simple and direct. It is recognized that many responsible agencies—in government, in architecture, in engineering, and so on—are affected by such a matter as building regulations, and that all can contribute toward the store of knowledge from which should come the best generally acceptable regulations. Hence, a guiding committee of those organizations most directly concerned is formed. Operating under this is a series of sectional committees each dealing with a specific subject. Recommended requirements are developed by the sectional committees, are inspected to see that they are consistent and form a well integrated series by the correlating committee, and are issued for general use.

The National Bureau of Standards is cooperating in the present activity. With something like 20 years of intimate contact with building-code problems, it has accumulated a background of experience in this field which is being continually enriched by the results of testing and fundamental research.

From this description, it will be seen that the machinery for producing recommended basic requirements is well organized and functioning with due regard to the fundamentals of the situation.

With reference to the special needs of housing, adequate arrangements are also in effect. The last Congress provided the National Bureau of Standards with a special appropriation for use in investigating the properties of materials used in low-cost housing. An advisory committee consisting of representatives from each of the Federal housing agencies has been set up which has outlined a program including special attention to the effect of obsolete building code provisions on low-cost housing. Studies are already in process designed to tie in with laboratory work on strength, fire resistance, and other properties of materials. With the facts well in hand, it will be possible to make definite recommendations regarding code provisions which are felt to stand in the way of better and more economical construction.

Thus, not only the long-term aspects of improved building regulations but also the immediate and acute ones are being attacked with the prospect that steady progress will be made in this phase of housing activity.

The production of recommended requirements is not enough, however. Two steps remain. The first is to adapt general basic requirements to special local conditions where this is necessary. The second is to get the new requirements actually adopted.

How Can We Get Good State and Local Regulations?

Anyone who has traveled this vast country cannot fail to realize that certain modifying conditions take effect in different regions. The relative severity of climate, the prevalence of earthquakes, tornadoes, and other considerations call for adjustments in general requirements. Rarely is this necessary as between neighboring municipalities, although strictly local matters such as the delineation of fire limits must be locally determined. For the most part, similar requirements are feasible over a considerable area having the same general characteristics. Since States are the political units having jurisdiction, this points to consideration of State requirements as a practical way of removing unnecessary local variations.

These local variations, often inexplicable on any reasonable grounds, have been a source of complaint for many years. Due to the operation of various forces such as the standardization activities that have been mentioned, they are less today than formerly, but they still represent one of the undesirable features of building regulation. They bear with particular weight on those manufacturers who are working on the problem of prefabricated housing units, since the advantages of mass production in a central plant are reduced or destroyed if changes have to be made to meet numerous special requirements.

Students of the subject have proposed an arrangement for building-code requirements that follows this sequence:

(1) Basic requirements are developed nationally, in the manner already described.

(2) State laws are passed setting up State boards empowered to draw up detailed regulations good for use throughout the State and enabling municipalities to supplement these with local requirements.

(3) The State boards, utilizing the basic requirements and taking cognizance of any special conditions that apply within the State, draw up requirements to the extent that is possible, excluding purely local variations.

(4) To these State requirements are added any necessary special features not in conflict with the State requirements, and local officials enforce the combined requirements. Outside of incorporated areas the State requirements also apply.

(5) When new materials or methods of construction are proposed for use, they are subjected to appropriate tests by the State board and, if approved, may be used throughout the State under the conditions laid down in the terms of approval.

(6) Basic changes to meet changed conditions, new discoveries, and other developments are made in the State regulations, which automatically produces a corresponding change in all local codes.

Such a procedure would stand a good chance of being hailed as logical if it applied to a situation where nothing had been done on the subject before. But it enters a situation where there are already some fifteen hundred local codes in existence which have grown up in response to accumulating needs. The presence of these codes naturally has resulted in traditions and attitudes about building regulations. With few exceptions, these traditions and attitudes are based on municipal rather than State action.

The power through which the municipality acts, however, is that of the State as conferred in enabling acts or city charters. (There are some modifications in the case of home rule cities.) There are cases where the State has chosen to exercise this power directly with respect to certain kinds of occupancies. Wisconsin, for instance, has an extensive code concerning public buildings, the term public being construed to cover buildings housing three or more families. Ohio also has a State code whose provisions also extend to buildings housing three or more families. These cases illustrate, however, the fact that the adoption of a State code is not the simple solution of the problem that might appear to be the case. In both States, there are numerous municipal codes having elaborate and not necessarily harmonious requirements. These supplement the State code. A general principle in such instances is that the local code may not weaken the terms of the State code but may be more restrictive and may go into greater detail.

Where, then, does this leave the proposal to simplify existing procedure? It merely emphasizes the fact that the State requirements should be fundamental in nature—such things as working stresses for materials, fire protection, exits, and so on—while the local requirements supplement these with provisions for departmental organization, location of fire districts, and other matters of local concern. It leaves unchanged the principle that new materials should not have to run the gauntlet of approval in each individual city and town but should be dealt with on a State-wide basis.

Two aspects of building regulations have emerged from this discussion. One is the production of adequate technical requirements. The other is creation of a rational legal system for putting these requirements into effect. Neither one can do without the other. A theoretically perfect legal system, lacking engineering features would be a meaningless empty shell, and a collection of sound engineering requirements would be completely ineffective without the proper legal machinery to put them into action. Combined, these two phases of the problem represent constructive achievement.

Even then, the chain of circumstances that leads to adequate safety is not completed. There must be proper enforcement.

Enforcement

Proper enforcement involves several considerations. There must be a sufficient force of trained personnel to check plans, make inspections, and detect violations of code requirements. This means that the community involved must be willing to pay the price of safety by appropriating a sufficient amount to assure adequate enforcement. The personnel involved should also be protected by civil service, to the end that impartial administration may be the rule, with no necessity of yielding to pressure for special concessions in order to keep one's job. Men who are conscientiously trying to protect the public and whose disagreeable duty it is sometimes to say "No" when safety is imperiled should not be harassed by insecurity of office and should be removable only for cause. The fate of the structure of building regulations rests on the character of the officials whose duty it is to administer them.

Something should be said of the limitations of building codes lest an impression be left that a good code properly enforced will assure satisfactory housing. Buildings may be sturdily built in strict conformity to code requirements and yet leave much to be desired. They may be poorly planned, unattractive in appearance, and provided with cheap finish and trim. Such characteristics may doom them to early obsolescence and encourage the deterioration of the neighborhood into a slum. The police power can do much to prevent undesirable construction but it is not a substitute for intelligence on the part of designers and integrity on the part of builders. There is a field beyond it in which good building practices must be fostered through public education and through the standards imposed by lending agencies as a condition for making loans. These supplementary measures are a highly important part of any well planned program.

In conclusion, it may be said that the direction to be taken with respect to building codes as they bear on housing is reasonably clear: Promote a better understanding of the nature of these regulations; support the work that is going on to produce improved technical requirements; work for a more unified legal structure which will prevent undesirable overlaps and inconsistencies; and lastly give encouragement to a finer administrative system which can enforce requirements without fear or favor in the public interest.

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